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PARTIAL DENTURE CONSTRUCTION

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PARTIAL DENTURE CONSTRUCTION

A TEXT BOOK DESCRIBING THE TECHNICS OF IMPRESSION TAKING AND
THE CONSTRUCTION OF THAT TYPE OF REMOVABLE PARTIAL
DENTURES WHICH ARE SUPPORTED AND RETAINED
BY EXTERNAL ATTACHMENTS

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WITH 401 ILLUSTRATIONS

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Introduction

I have been led to write this book because there appeared to be no complete work on Partial Denture Construction in our literature. This book has been primarily prepared for students, but as we are all students I hope that it may be of some material assistance to men who are in practice and more especially those who were graduated before present day technics were taught in their schools. The methods described are those only with which I have had experience by use in my own practice.

I have limited myself to that field of Partial Denture Construction which uses external attachments, because I think that those types which depend upon internal attachments have been fully described by others and might well demand a book as lengthy as this one in order to adequately delineate all of the details of construction.

I have also limited myself to the description of methods that are practical and which have been in use for more than six years. The dentures shown in the illustrations have all been successfully worn and a great majority of them for at least that length of time. It is my belief that no one method of impression taking and no one method of clasp technique will answer in every case. We cannot always use a cast plate, nor can we always use a swaged plate. Hence I have endeavored to describe the different methods in the hope that the dentist will familiarize himself with all practical technics and thus discover for himself which will be best suited to his individual patient's peculiar needs.

Edward Kennedy.

February 1st, 1928.

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PARTIAL DENTURE CONSTRUCTION

Partial Denture Construction

CHAPTER I

Partial Platework

This chapter is entitled "Partial Platework,"* notwithstanding the fact that the main title of the book is set down as "Partial Denture Construction," because no one will confound "platework" with "bridgework," either fixed or removable. Yet the term "platework" is not entirely comprehensive because the substructure of many "partial dentures" are of skeleton form, which hardly agrees with the original meaning of the word "plate."

The author likewise realizes that the term "partial denture" has not as yet a standardized meaning. He knows that every piece, exclusive of fixed bridgework, (and of course full dentures) might be called a "partial denture." In undertaking the writing of this work he believed that there is a field in textbook literature, for a treatise on the technics of that type of partial denture which is retained, or supported, by what may be called "external attachments." Partial dentures supplied with "internal attachments" bring us to a subject requiring a separate book. By "internal attachments," the author alludes to those attachments constructed in two parts of which one, "the female member" is fixed within the periphery of the abutment, the other, the male member being united to the denture.

In approaching the problems of partial platework, the dentist should have a clear conception as to just where platework ends and bridgework begins. It has been the habit of some men to call a plate a bridge (Fig. 1) and their conception of the difference between bridgework (Fig. 2) and platework has been so faulty, that they have been led to make improper designs.

---

*The term "platework" is distasteful to the author, but the alternative word "denture" has too broad a meaning for universal use. In this work therefore "plate," and "platework" will refer to that part of the structure which rests upon soft tissue, while "denture" will comprise the completed structure, including the "plate" or substructure, and the attachments and the artificial teeth, the super-structure.—Editor.

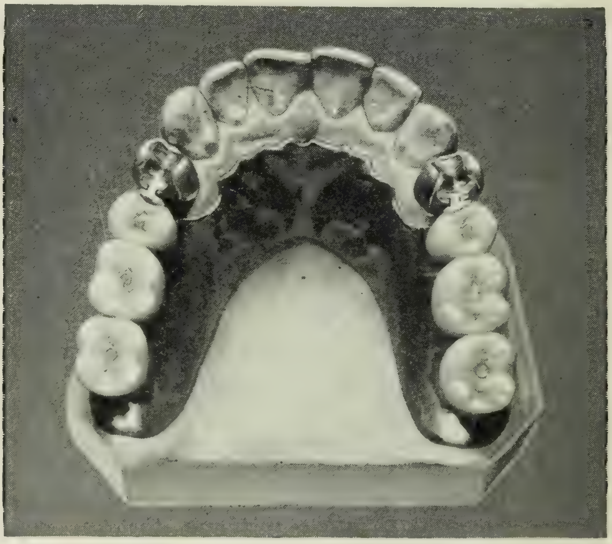


Fig. 1. The designer called this "a bridge," but it is really a plate.

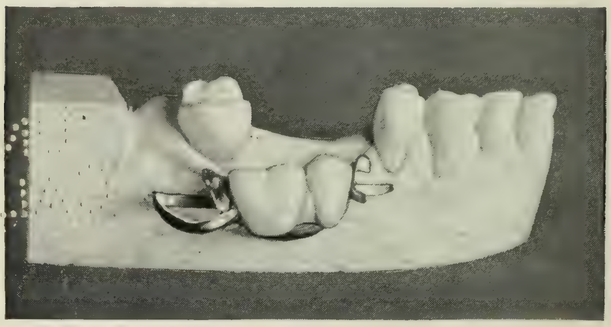


Fig. 2. This type of denture is sometimes called a "Bonwill plate." But it really is a bridge.

The importance of proper design was well brought out in a discussion with Dr. Norman Nesbett, of Boston, as to why so many cast clasps have failed in platework. ✓Dr. Nesbett made the statement, that he designed the cast clasp to act as a rigid support for the bridge that bears his name.

These clasps were to take the full stress of mastication. Immediately they were used in partial platework which had extensive saddles. The movement of the saddles, on the flexible gum tissue, produced excessive strain on the teeth, which ultimately brought about the absolute loss of teeth, due to the fact that the clasps were not flexible enough.

Classification of Partially Edentulous Arches

No branch of dentistry has progressed rapidly until cases have been classified. As proof of this, we have only to look at the kindred subject, orthodontia, and realize that before the time when Dr. Angle presented his classification, cases were handled in a rule of thumb manner, with varying results.

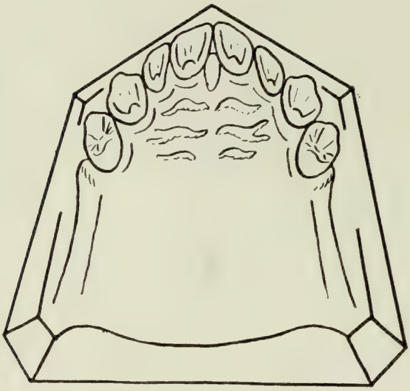
We have a very labored method of describing cases. Men often present a problem of partial platework and say, "What would you do in this style of a case? All the teeth are present up to the bicuspid on the right side of the mouth, the first bicuspid is missing and," . . . then he describes the vacant spaces which are in the mouth. How much easier it would be if he could say, "I have a Class I, upper, or a Class II, upper with this modification," just as the orthodontist does. We prosthodontists cannot hope to understand each other, unless we speak a common language.

We must remember that a partial plate, resting mainly on a compressible base, must be so designed as to overcome excessive stresses of mastication, and to prevent the drag on teeth which have attachments placed upon them, or in·them. This is further complicated, when we take a simple type of plate, which depends on the saddles for support, and add to it a number of dummies, which are supported entirely by the abutting teeth. This requires a nicety of design, to overcome the conflicting movements of the saddle and the more rigidly supported dummies.

There have been several classifications proposed, most of which depend on the type of attachments to be used, or the form of the saddle, or the condition of the ridge on which the saddles are to rest. This brings us such multiplicity of cases, that I believe one prominent prosthetic writer has claimed that it is possible to obtain one million eight hundred thousand variations, in partial cases, when these methods are followed.

It is practically impossible to write an article on partial dentures, and successfully convey to the reader any method of handling these cases, unless we are able to classify them, and it is with the recognition of the difference between platework and bridgework that the writer proposes the following method of classification, which depends on the relations of the saddles to the teeth which are to receive the attachments. This greatly simplifies the classification, and permits us to divide all partial cases into four classes, with a few subdivisions under each class. The subdivisions cover those

Class I



Class II

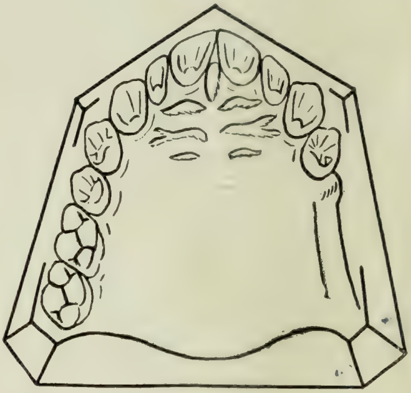
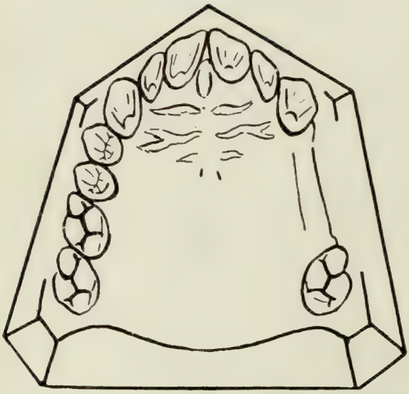


Fig. 3. Class I. Saddles posterior to the attachments and bilateral.
Fig. 4. Class II. Saddle posterior to attachment and unilateral.

Class III



Class IV

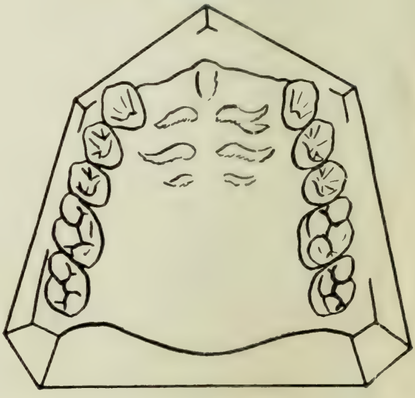


Fig. 5. Class III. Saddle unilateral; attachments anteriorly and posteriorly.
Fig. 6. Class IV. Saddle anterior to attachments.

cases in which there is a combination of bridgework with platework. By bridgework, I mean where we can obtain support at both ends of the edentulous space, by means of lugs, or attachments, which support the major part of the stresses of mastication. At first this might appear puzzling, but in actual practice each class rarely presents more than four modifications. Mathematically it would be impossible to have more than six divisions. We will illustrate only four modifications under each class, and only one type of partial plate is omitted; that type where there is only one remaining tooth. While it is technically a partial plate, it could well be considered a full denture; hence it is not believed to be necessary, nor wise to include it in the classification.

The important idea to be held in mind when planning a denture, is just how it will move when placed under the stress of mastication. Consequently it is necessary to present our classifications at this time.

Class I. Class I is that type of case where the saddles are bilateral and lie posterior to the attached teeth. This type of partial denture is the most common. (Fig. 3.)

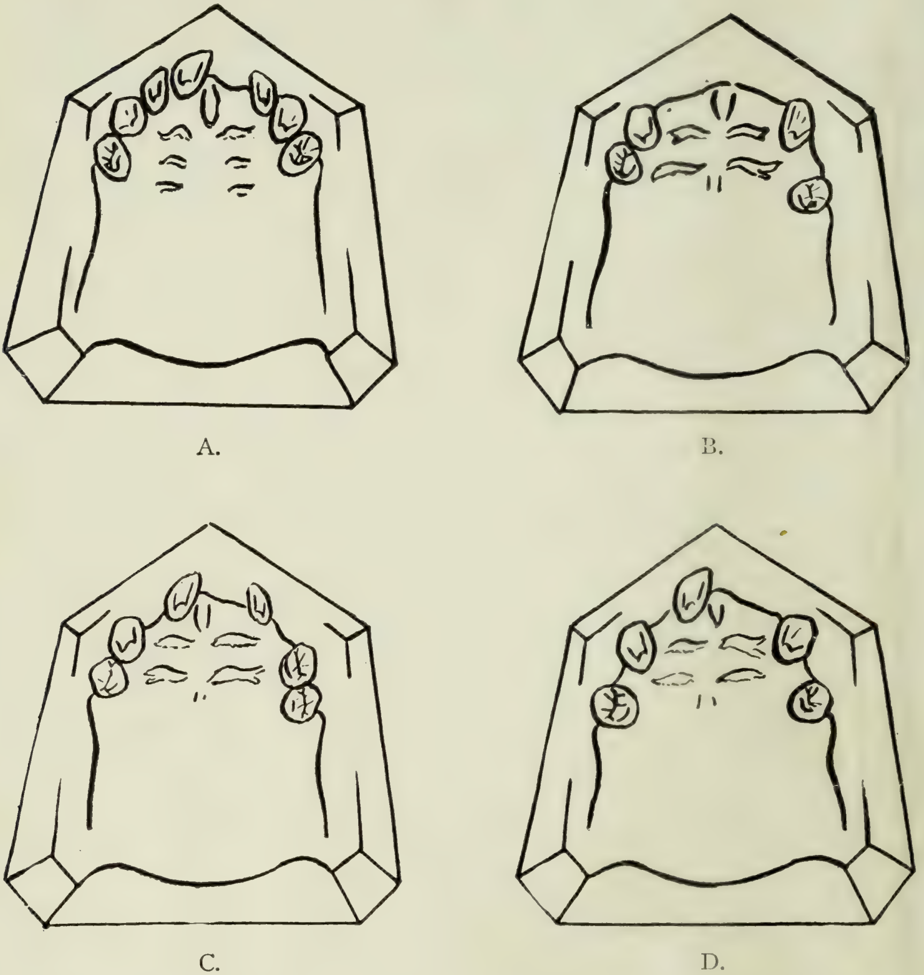
Class II. Class II is that type of case where the saddle is unilateral, and lies posterior to the attached teeth; that is to say, where we have all the teeth remaining on one side of the mouth, and all of them missing on the opposite side. (Fig. 4.)

A common type of this class is where the bicuspids and molars are missing on one side, and all the other teeth are present. In many instances the teeth have been lost through faulty restorations, or faulty root canal fillings, and as the patients object, and rightfully, to the further mutilation of the teeth, the dentist is presented with the problem of supplying something, which will not deform the patient, nor cause a further loss of teeth. If this type of case is handled properly, a satisfactory denture can be constructed without mutilation of the remaining teeth, but a careful study must be made as to the stresses of mastication.

Class III. Class III is that type of case where we have teeth missing on one side of the mouth, the saddle having support anteriorly and posteriorly. (Fig. 5.) This type really demands bridgework, but very often the supports are so frail that the greatest stresses of mastication must be borne by the saddle. Dentures for this class are easily designed but difficult to adjust, requiring a nicety of workmanship.

Class IV. Class IV is that type in which the saddle is entirely anterior to the attachments. (Fig. 6.) The most common is where four of the labial teeth are missing and none others. It presents no modifications.

It is very simple to decide into which class a case falls, provided there are no modifications. The modifications would be modifications I, II, III, or IV according to the number of openings found in the line of teeth which are left standing.



A. B.

C. D.

Fig. 7. Class I. A, Modification I. B, Modification II. C, Modification III. D, Modification IV.

Modifications. Modification I, of Class I, would be a single opening, as due, for example to the loss of a central or lateral incisor, or a cuspid. (Fig. 7 A.)

Modification II, of Class I, would be where two spaces are left, not connected; that is, there are teeth standing between. (Fig. 7 B.)

Modification III, of Class I, is where three spaces are left; teeth standing between. (Fig. 7 C.)

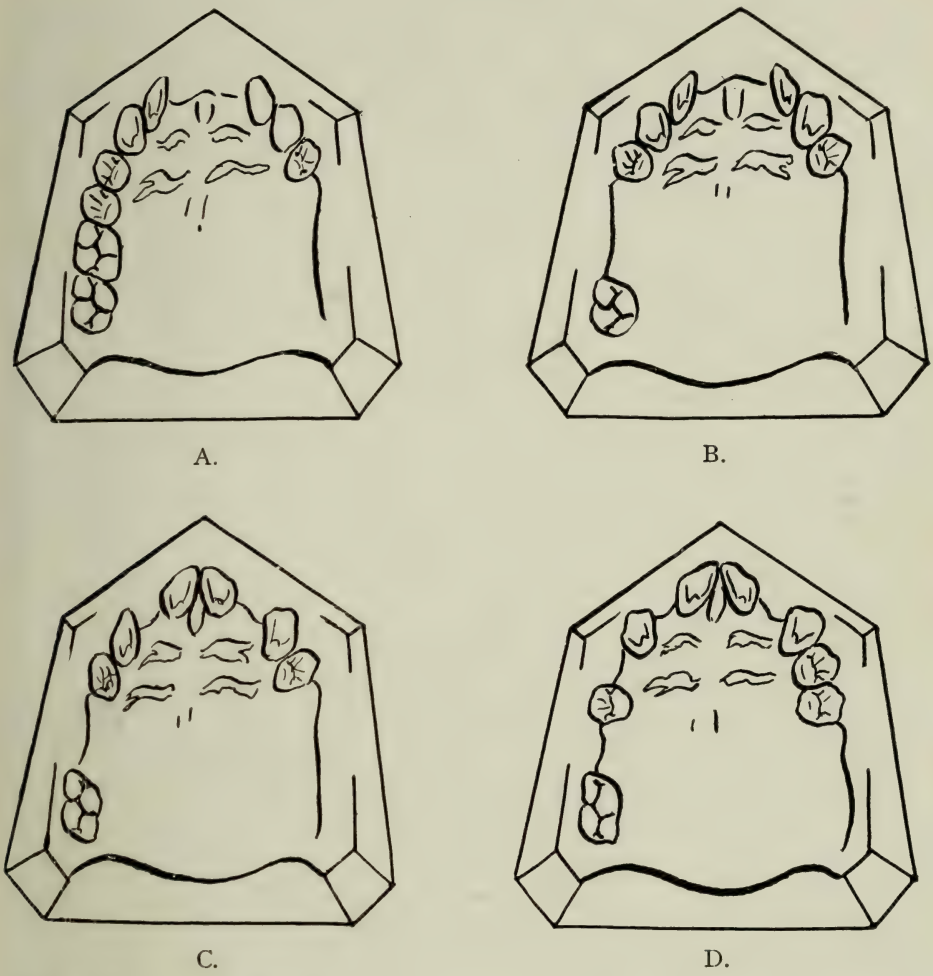


Fig. 8. Class II. A, Modification I. B, Modification II. C, Modification III. D, Modification IV.

Modification IV, of Class I, is where four spaces are left; teeth standing between. (Fig. 7 D.)

The same is true in the other two classes, Class II, and Class III. (Figs. 8 and 9.)

Class IV does not admit of modifications, because if more than one space were present, it would fall under the head of Class I, II, or III.

The author believes that this classification is based on sound reasoning, because it readily lends itself to denture design, taking into consideration, saddle movements under stress of mastication, and Dr. Cummer's theory of indirect retention, which was primarily designed to prevent saddle movement.

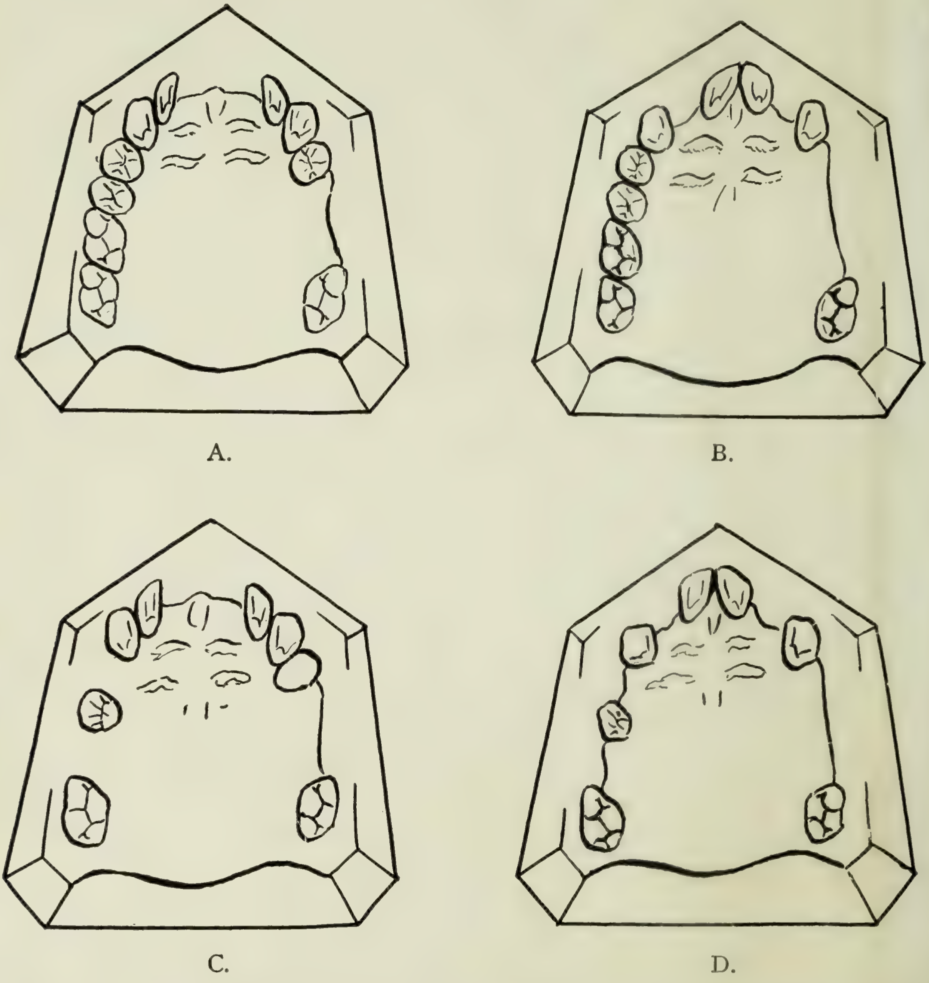

A.
B.
C.
D.

Fig. 9. Class III. A, Modification I. B, Modification II. C, Modification III. D, Modification IV.

Diagnosis of a Case

Let us now study the simplest case and the most common which presents in practice; Class I, lower. In designing a bar plate for this case, we must consider several things. The type of ridges, whether they are soft or hard; the condition of the teeth which are to be clasped; the condition of the teeth which are not clasped, and the location of the muscle attachments around the borders of the saddles.

It is seldom that we find soft ridges in this type of case, although we often find a softened area at the extreme rear, which is rather a help than a hindrance, because if such is the case and these areas are properly compressed when taking the impressions, they will tend to provide suction to the saddles.

If the teeth which are to be clasped are molars, strong bicuspids, or cuspids, and are in an alignment, parallel with one another, almost any type of clasp or attachment will give satisfaction for a considerable number of years. The wrought clasp is as satisfactory as any form of attachment, provided it and the tooth which it clasps are kept clean by the patient.

If the ridges are hard on both sides of the mouth, the flat plate clasp, or round, or half-round wire clasps, made with lugs, are indicated. The flexibility of these clasps acts as a stress-breaker, provided we have occlusal lugs in connection with the clasps.

If the ridges are soft on one, or both sides, we must consider what will happen under the stress of mastication. If the patient chews on one side of the mouth, and the ridge is soft, the saddle is bound to be depressed, so that a form of movable attachment on the clasp will be indicated. If the ridge is soft, all the way back, the entire saddle will be compressed downwards, and an attachment which permits of an up-and-down sliding motion will be required, while the clasp remains firm on the tooth. If the ridge is hard close to the attached tooth, and soft in the posterior region, there will be an uneven tipping of the saddle, and the attachment used must be of a type which combines the hinge motion, together with the slide motion.

If the ridge on the opposite side of the mouth is hard, biting on the side which is soft will cause this saddle to have a slight lateral motion, and here, an attachment of a type which allows a slight rotation must be used.

On the other hand, if the entire ridge is soft, the slide type of attachment must be used, combined with one which allows movement of the saddle from side to side. Again, if the ridge is hard near the attachment and soft posteriorly, a hinge type must be used, as on the opposite side.

Thus it is readily seen, that in relation only to the softness or hardness of the ridge, five different movements of the saddles must be considered and compensated for, by using the type of movable attachment on the clasp, which permits these movements, without placing strain upon the attached teeth.

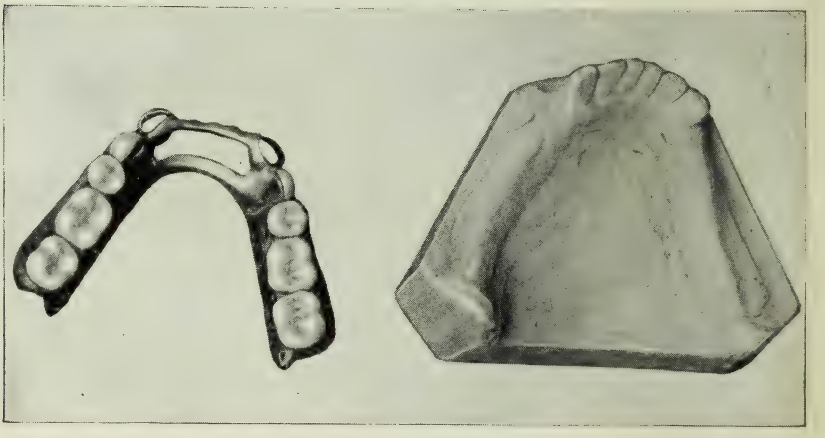


Fig. 10. Double bar plate; sometimes called "continuous clasp."

This presupposes that the clasps are properly designed, which will be discussed in the chapters on clasps. If the ridges are hard and non-compressible, the muscle attachments are close to the top of the ridge and the plate has a tendency to rise in the back, a double bar plate would be indicated. (Fig. 10.) These double bars are sometimes called continuous clasps. In almost every case of the Class I type, they solve a great many of the difficulties of bar construction. Such a plate acts as an indirect retainer, preventing the rear of the plate from rising. It also prevents the settling of the bar, when properly designed to rest on the basilar ridges of the anterior teeth. It acts as a splint and stops the movement of individual teeth. If any movement does take place, it must take place *en masse.*

There is nothing more discouraging, after a beautiful lingual bar denture has been constructed, depending for its support upon attachments to only two teeth, than to find the patient returning and pointing out a movement of the remaining teeth, one or more of which are crowding out of their natural alignment.

During the year 1913 I constructed one of these plates which is similar to the one shown in Fig. 10, which has been worn constantly by the patient until the present time, with no appreciable settling, or movement of the teeth, such as had been started by her previous denture. After observing this case for about three years, I made it almost a universal rule to use the double bar, with practically no objection on the part of the patients after the first few days of wear. I have removed three, at the request of patients who claimed that they bothered the tongue. Two of these have been replaced and the patients now tolerate them. In each instance requiring removal, the patient was highly organized and extremely nervous.

I believe that the double bar solves the problem in partial denture construction for Class I. It offers an advantage over the old fashioned cast, or swaged gold plate, which rests upon the gingival margin of the gum, causing recession, or decay at this point, and likewise offers a means of attaching teeth when they are lost in the anterior part of the mouth after the plate has been worn, without the necessity of reconstructing the plate.

Settling of Plates.

Attention must be given to the possible settling of a plate and when necessary it must be rebased, to prevent excessive strain on the attached teeth. A great deal has been written on the settling of plates and the pulling of the natural teeth to which they are attached out of alignment, and the writers are justified, to some extent, in condemning the clasps made without stress-breaking attachments. A great deal of this type of trouble is due to the fact that the clasps are too rigid. The cast clasp in many instances is responsible for the failure of the denture. If a light spring clasp is used, often it will bend to the new position before the tooth is loosened.

Movements of the saddles which cannot be prevented must be compensated for by the springiness of the clasp, by the indirect retainer, or by some form of movable attachment to act as a stress-breaker. It has long been the belief of the writer, and later observations have strengthened this belief, that teeth are not loosened by the plate moving antero-posteriorly, but from side to side, except where a cast clasp is used which is too rigid in its construction.

If teeth were loosened by the settling of plates posteriorly, these teeth would certainly be dragged backward, and a space left between those in front. I have failed to observe this in my own work, or in that of others. But I have seen numerous instances where the teeth were loosened by a lateral motion of the plate, or because of the fact that the clasps were placed below the lingual contour of the teeth when these teeth lean toward one another, or below the buccal contour when they lean away from one another. When such a plate is placed in position it goes in with that beautiful "snap," which so many men like to hear; but in every instance I have observed that when a plate snaps into place, the tooth is loosened within a few weeks.

If we stop to think what that "snap" means, we will realize that it is simply the forcing of the plate over the contours of the teeth, and that the teeth must be forced either away from one another, or toward one another, according to the way they lean. This constant forcing soon loosens the teeth. It would not be so bad, if it only occurred when putting the plate in, or taking it out of the mouth, but the wedging action of the inclined planes of the clasps takes place every time the patient bites, when the saddles give under the stress of mastication. So this is the cause of the loss of so many clasped teeth. A great deal of this could be prevented if the clasps were supplied with proper occlusal lugs, which would help to prevent lateral motion of the plate, and at the same time act as a contact point to prevent food from being forced down between the clasp and the tooth.

If the food is of a fibrous, or granular nature, the peridental membrane is forced back, forming a pocket, or exposing the cementum, which is soon attacked by decay. The lugs will not withstand the stress of mastication unless the saddles are given their proper bearing. If a marked settling takes place over the posterior portion of the saddles, due to recent extractions, or a soft area at this point, the lugs will break, or the plate will rotate around the lugs as a center, or the clasp will loosen from the tooth. The patient will generally seek the dentist for relief before much damage can be done to the tooth.

One of the great advantages of the double bar before mentioned, is; first that it assists the lugs; secondly, if the plate settles very much on the posterior end, the upper bar will rise from the teeth and the patient will complain of it. This is always a warning that the plate needs rebasing. The author has gone into the subject at some length, because he wants to impress upon his readers the necessity for care in designing the denture. If the simplest type of plate has so many factors involved in it, the modifications have many more factors.

Unless the student of platework is willing to study the stresses and strains which are applied to the teeth, and learn how to overcome them by proper design and careful readjustments of the plate after it has been worn, he will never succeed as a partial plateworker and can expect only the most dismal failures in the more complicated types.

Slotted Inlay Attachments.

I do not believe that the slotted inlay attachments are indicated, or advisable in Class I restorations. After a number of failures in my own hands, and after seeing failures from men who are masters in the use of the slotted attachment, I have concluded that they should never be used unless there is some posterior support. Extensive saddles on one side of the mouth should not be used, even though they have posterior support, unless bars are extended to the opposite side of the mouth to prevent lateral motion.

I have seen a number of cases where the dentist, to get rid of the patient's objection to the bar, has been led into the error of using a slotted inlay in a bicuspid, with a small extension to the cuspid.

In some instances this has been tried on both sides of the mouth with no connecting bar, and every case that I have seen was an absolute failure, the teeth which contained the attachments being lost. It is equally fallacious to use clasps in the same manner.

The slotted attachments do service for a while, in the Class I type of case, if the ridge does not absorb and they have the advantage of preventing the forcing of food between the natural teeth and the plate. But as soon as settling takes place, they always break.

The only objections to a properly made clasp are its unsightliness and the fact that a great many men claim that they cause erosion of the teeth.

The first objection is valid, but if the lugs are properly made and double bars are utilized, very small clasps can be used. The second objection, I do not believe is sound. If the clasps are properly designed to cover the largest portion of the tooth, which necessarily is the thickest portion of the enamel, and are supplied with proper lugs to prevent settling, keeping the clasps from wearing on the cementum, and the patient is instructed in the prophylactic care of them, I believe they are the most satisfactory attachments for the Class I type of case. When broken, they are easily repaired; small round wire clasps are not unsightly, and at the same time, if they do not touch the cementum, they produce less erosion than any other type. They can be readily adjusted by any good dentist, and they are capable of withstanding much more abuse on the part of the patient.

CHAPTER II

Reception of Patients and Office Equipment

If we wish to attract a refined clientele we must have an artistically furnished office and above all else it must be clean. The little money spent on tiling, or keeping the paint and floor coverings in shape, more than repays itself many times. It is not necessary to have a large suite of rooms, nor a great display of expensive equipment. In fact I think the average patient prefers a simply furnished operating room, where most of the instruments are kept out of sight.

Some patients are very sensitive as to the manner in which they are approached. They do not like the dentist to stick his fingers into their mouths the first instant they get into the chair. It is always better to use a mouth mirror for a preliminary examination. Do not demand the immediate removal of dentures. Wait until the patient has become a little acquainted with you and until you have thoroughly examined his mouth with the existing dentures in place.

Services of Woman Assistant.

If the young dentist is fortunate enough to be able to have an assistant, she should be dressed in white and her hair covered by a cap, or a net. It is much better that his assistant should place the patient in the chair, adjust the napkin, and see that nothing is neglected in the neatness of the room, before the dentist talks to the patient. She should also obtain the patient's name, address and telephone number, put them on a record card and place the card before the dentist for reference, during his consultation. If he can call the patient by the right name, he sometimes is saved a good deal of embarrassment.

Washing the Hands.

It is not best for the dentist to wash his hands in the presence of the patient, because it is usually done in a rather perfunctory manner, as his attention is distracted by whatever the patient is trying to tell him. While I have wash basins in my operating rooms, I seldom use them for the purpose of washing my hands, but prefer to wash my hands in the sterilizing

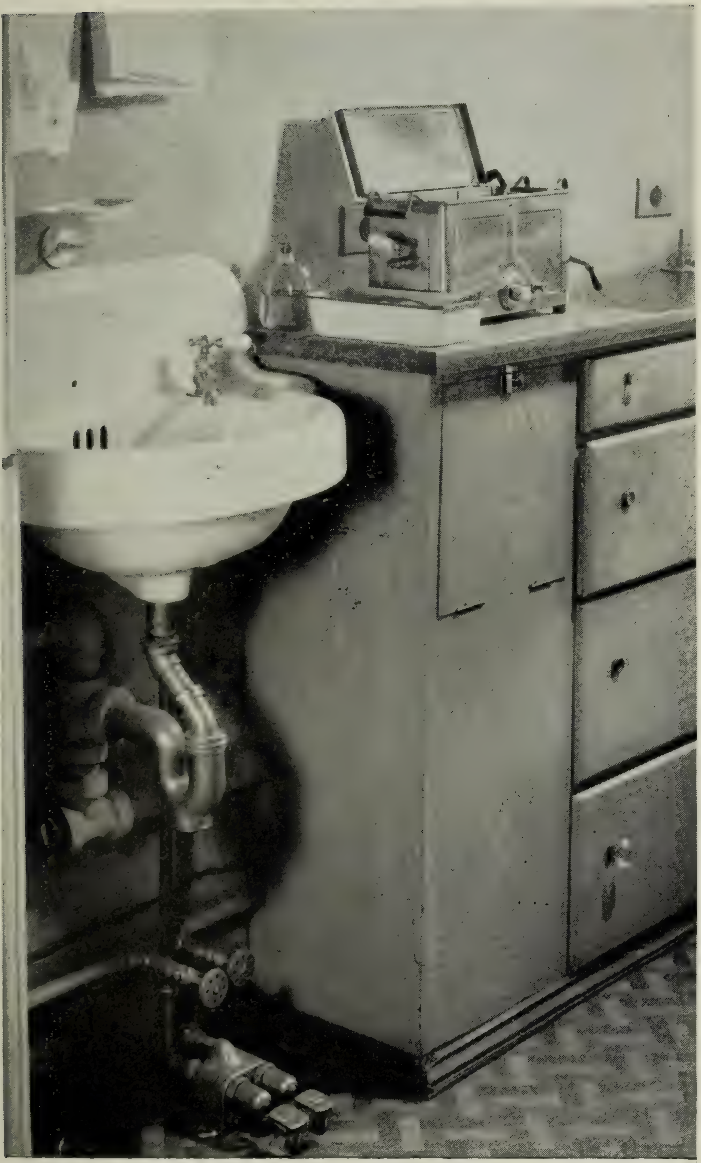


Fig. 11. Corner of the sterilizing room. Note pan for hand brushes, alcohol in shaker bottle, foot connections for the water taps.

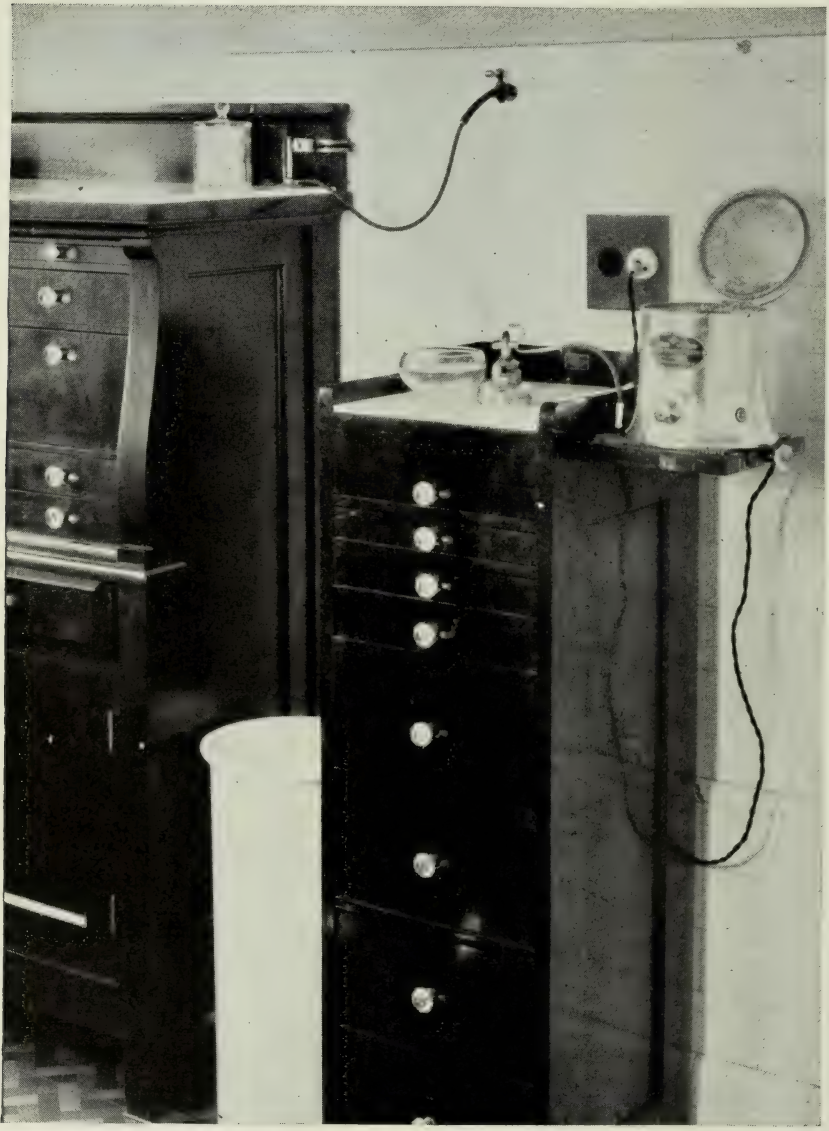


Fig. 12. Impression bench; Monson compound heater; Alcohol burner, Tench blowpipe and bowl for ice-water. Note white container for catching chips and waste.

room. If it is thought that the patient is particular about knowing whether you have washed your hands or not, wash them thoroughly in your laboratory, or sterilizing room, and appear before the patient with a clean towel while drying them. This will satisfy the sensitive patient on this point. It also avoids your shaking hands with the patient, which would break the chain of sterilization.

Sterilization. Many men have their sterilizers in view of their patients, or have some form of glass box with "Sterilizer" printed on it, with a view of impressing the patient that everything is taken care of as far as sterility is concerned. In reality the glass box "Sterilizer," does not sterilize, and in many instances, the hand and plate brushes which are constantly used are very unsterile. The dentist very often works on a pus case, or a specific case, or handles an abscessed root which has just been extracted, goes to the tap, smears the handle with the highly infectious material, carefully washes his hands for the next patient, turns off the tap, re-infects his hands, and all unthinkingly endangers the patient. We could well afford to watch our surgeons and see the care which they exercise in this respect. Our hand and plate brushes should be placed in a shallow pan (Fig. 11), and the bristles covered with a solution of tincture of green soap. We should also have a shaker bottle of alcohol which can be poured on the hands if we know we have handled a specific case. It is well to have a dish with a cover on it, containing 50% alcohol and water, wherein the appliance can be placed for a few minutes after polishing with a felt cone, as it is impossible to properly sterilize felt cones and polishing brushes.

The water tap should be connected with either a foot, or knee treadle. This not only saves time but prevents any break in the chain of sterilization. I have one faucet, which is connected with a Mott foot tap which cost only nine dollars. The other two basins supply both hot and cold water, and I think the cost was eighteen dollars each. Hence I do not believe it pays any dentist to neglect this detail.

We also have a jar of 30% calomel ointment and one of phenlin oris, manufactured by John H. Wood, Philadelphia. Calomel ointment is used on cuts and cracks, on the operator's hands, in case he suspects the existence of specific disease. The phenlin oris is used for cracks on the lips of patients, and assists us when we are slipping the impression in and out of the mouth. K.Y. jelly is a good substitute for this.

The working surfaces of the tables should be covered with white glass which can be easily sterilized by wiping with alcohol.

There should be a means of heating the modelling compound, as all of the study impressions are taken with this material. I know no better heater than the Monson compound heater, shown in Fig. 12. It is capable of being sterilized as it has a switch on the side, which allows the water to be brought to a boil. It has a cloth bag attached to a ring, which prevents the compound from adhering to the heater. If this switch is used, do not have the lid down while there is compound in the heater, as the water will boil and the compound will adhere to the inside of the lid. There is a small electric light which goes out when the temperature goes too high, and a thermostatic regulator in the front, which maintains the needed temperature and should be set for 145°. It is necessary to check this temperature with the thermometer on the opposite side of the heater, which gives the temperature a little lower than the water actually is; the thermostat records it a little higher, as it weakens with constant use. 145° is the temperature for taking impressions with the Kerr compound.

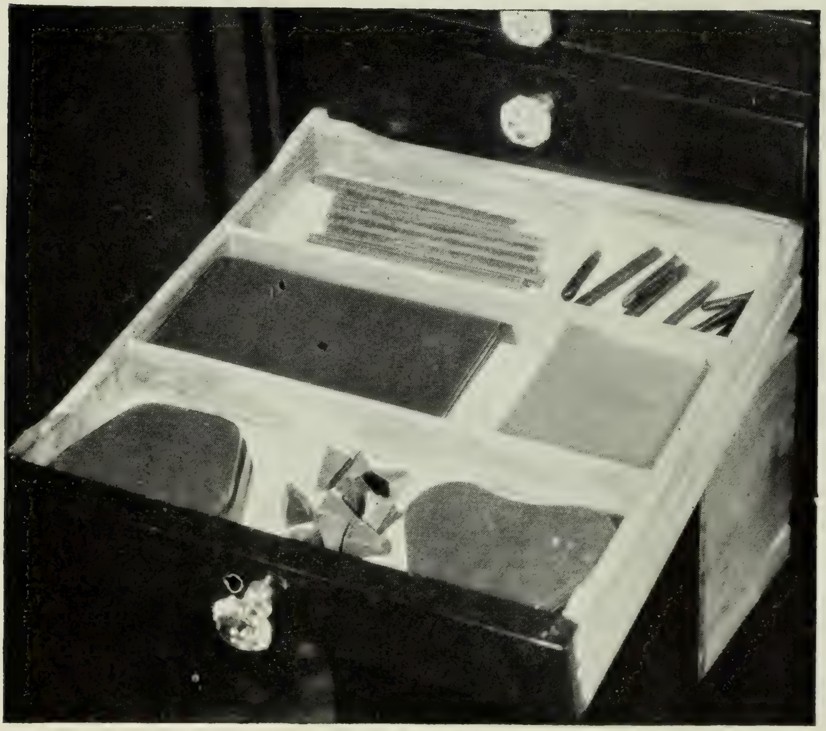


Fig. 13. Arrangement of wax and compound in drawers with bottom lined with Sanatas cloth.

There should be a bowl of icewater at hand so that we can dip our impressions and harden them after removing them from the mouth; also an alcohol burner with a Tench blowpipe attachment; a penknife, preferably made of all metal so that it can be sterilized, and some squares of gauze to dry off the impression, or wipe out small chips. I also have a white fibre umbrella stand (Fig. 12), which catches the chips as they fall. These can be purchased from the American Fibre Co., and if they become soiled, can be painted with white enamel paint. They are made of the same material as the containers which florists use for holding flowers in their ice boxes.

The wax, compound, and impression trays, should be kept in the drawers of the cabinet. (Fig. 13.) I experimented with a number of materials for use in the bottom of drawers, first using white paper, then glazed paper, then celluloid. While the last mentioned was the cleanest looking, it had a tendency to curl up. I found that the white Sanatas oilcloth, which is used to cover kitchen table tops and pantry shelves, is perfectly satisfactory. It can be washed and looks very nice in the drawers of the cabinet.

Radiographs. Radiographs should also be taken if the patient has not already had them made. I find that a number of patients come in with a series of good radiographs, expecting them to be used. If so, they should be placed in an envelope with the patient's name on it and filed in a suitable drawer. Nothing is more exasperating than to have a patient, (having decided to have the work done elsewhere) ask for his radiographs, and then to find that they have been misplaced. To avoid this, I have manilla business envelopes in which the patient's radiographs can be filed, and a notation is entered on his working card to the effect that the radiographs were left with us.

This precaution should also be taken in the case of old dentures, or bridges, which the patient may bring in to be used in matching teeth. I have had two instances where patients claimed to have left dentures in the office and became very much irritated because they could not be found. In both instances they were found later in their homes.

Record Charts. A chart should be used when making an examination of the teeth in the mouth. Any good dental chart is acceptable, but I do not believe that it is wise to have accounts on the same chart on which the examinations are noted, as often, the patient will pick up the chart, and if charges are to be seen, a discussion may ensue about fees at a time when the dentist does not wish to go into this matter.

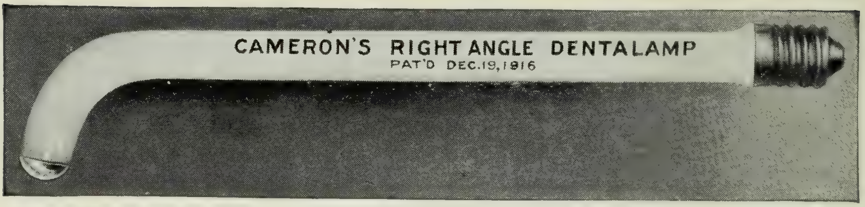


Fig. 14. The Right-Angle Dentalamp.

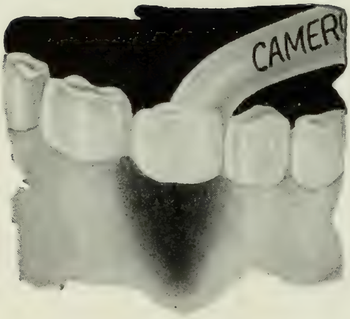


Fig. 15.

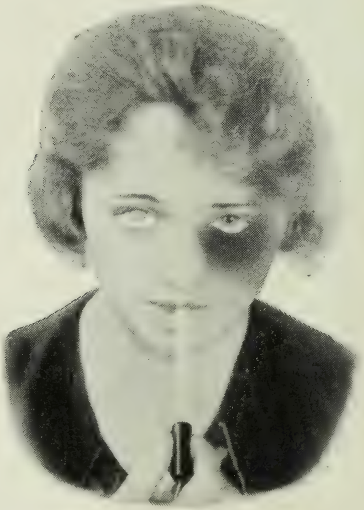


Fig. 16.

Fig. 15. Opaque area indicating infection.
Fig. 16. Transillumination of sinuses. Left maxillary infection.

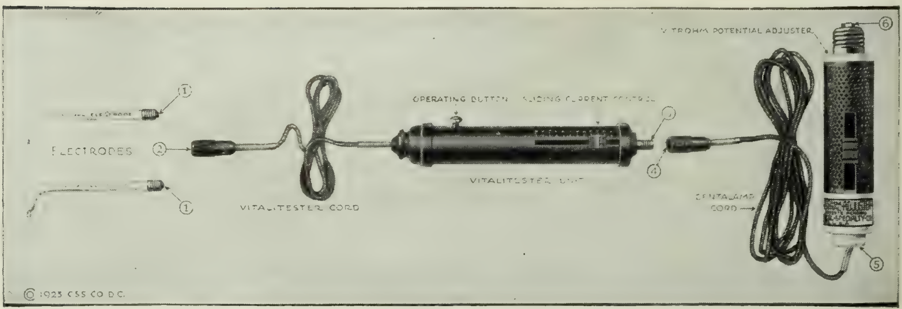


Fig. 17. Chart of assembly of the Vitalitester for testing pulp vitality.

We should begin at the upper right side of the mouth, noting on the chart the physical appearance of the teeth; whether the cavities are properly filled or unfilled; whether the root canals are filled; any marked gingival recessions or large pockets; small pieces of roots remaining; cystic conditions, or growths in the mouth; replacements, and especially devitalized teeth.

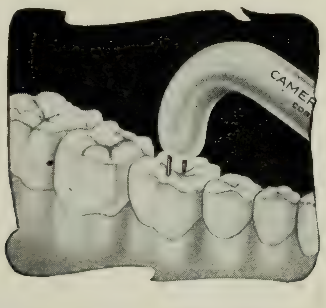


Fig. 18. Method of contacting Coronal Electrode on occlusal surface of tooth under test.

On the cards there should be spaces for the different classifications, shades of teeth and remarks. These can be placed on the back if one desires to keep the cards small.

The Dentalamp. In an examination of the mouth a dental lamp and a pulp tester are almost necessities. The Cameron Dental Lamp Co. has devised a lamp known as the Dentalamp, (Fig. 14) which can be sterilized and which works from an ordinary lamp socket. This is of great assistance in disclosing devitalized teeth where the dentist does not have an x-ray machine in his office. The lamp is placed against the gum back of the tooth and it is so curved that it nicely fits the mouth. (Fig. 15.) If the tooth is devitalized it will show distinctly darker than the other teeth. If the room is darkened one can very often determine whether the frontal sinuses, or the antra are involved and contain pus. (Fig. 16.) This is of great assistance.

Pulp Vitality Tester. The same company supplies a very useful apparatus for testing pulp vitality. (Fig. 17.) There being limitations to both radiography and transillumination it is well to use the vitality test as a routine in making a diagnosis. When using the tester it is only necessary to contact the two platinum points of the electrode to the most convenient surface of the tooth to be examined. (Fig. 18.)

The Value of Probes.

It is surprising that the dental schools do not instruct students as to the great value of the probe. Radiographs are useful but they seldom show the extent of pockets, and there are often times when a radiographic examination cannot be made. Even at one of our large hospitals in New York City, I have been unable to obtain a radiograph for at least two days, due to the fact that the x-ray laboratory was closed on Sunday and on a succeeding holiday. I recall one instance where it was thought that a swollen face was caused by an infection of a flap, back of a third molar, which proved upon probing through a fistula just anterior to a second molar tooth, to be due to an impacted first molar, which is rather an uncommon occurrence.

If you do not have a silver probe, an ordinary explorer can sometimes be substituted, and it would be well for a dentist to practice exploration on known areas. Necrotic bone at the end of an explorer feels like decayed wood, while enamel feels exactly like glass.

Judgment should be used however, as an operator when probing in the region of the antrum must be careful not to infect it. If he has swabbed the socket out with iodin and uses a dull probe which has been sterilized by dipping in alcohol and flaming it, there is no particular danger.

CHAPTER III

Preparation and Use of Study Models

If the operator has a conception of proper design, it will be necessary for him to obtain, either a model, or a diagram by which he can design his denture. Dr. Cummer has suggested the use of a number of small rubber stamps, and when a case is presented, he picks out the type of rubber stamp that most nearly approximates and prints it on the back of the record card. He then makes a diagram of the teeth and designs the denture in pen and ink on this outline. If the student desires to follow this method, he can take the diagrams of the different types of cases accompanying this work and have them made into rubber stamps, purchase an inking pad and follow the above plan.

Study Models. I believe, however, that the use of a study model is by far the more satisfactory method, as it not only gives the design of the denture in the flat, but allows us to see difficulties which might occur, due to the leaning of the teeth, excessive contours on the teeth, or hard spots which might interfere with the bars or plates which would rest on the soft tissues. If these models are carefully made and mounted on articulators of the proper design, a comprehensive study of the case can be made before the patient returns.

Many cases which are started with an idea of completing them in a certain manner, necessitate a change in design when the study models are considered. If you have informed the patient that a certain procedure will be followed and then, after starting the case, you are compelled to change to a more complicated one, you create the idea in the patient's mind, that you were not thorough in your first examination, or else that you are making the work more complicated with an idea of increasing the expense. No one cares to have his ability, or honesty, doubted, and the simple procedure of outlining the case to the patient and adhering to that plan, will very often put him in a better frame of mind.

Even a novice can see that if he gives an estimate for a denture, and is compelled later to change the design, adding two or three inlays to obtain rests, or cutting down a tooth and placing a jacket crown thereon, he would be compelled, practically to double his fee, or give the patient this extra work for nothing, either of which courses would be unfair to himself or to the patient.

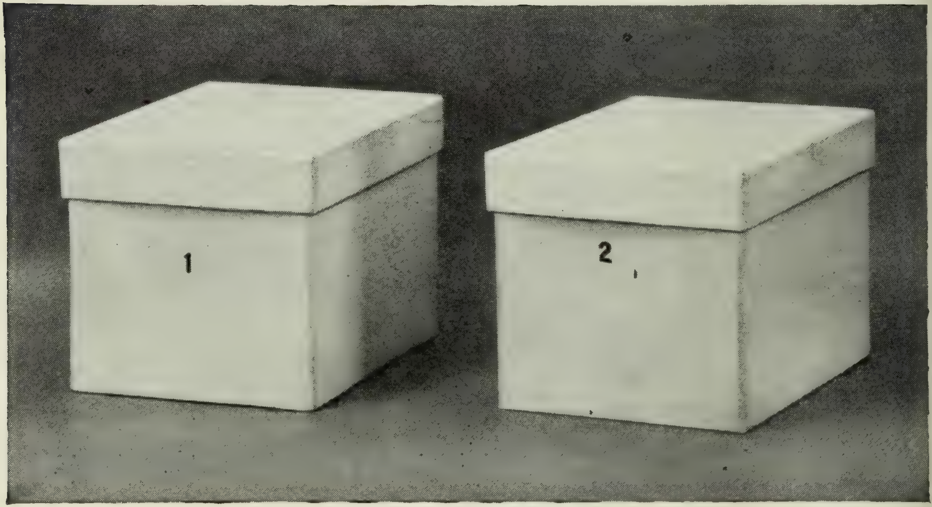


Fig. 19. Boxes for storing models.

It is as impractical to attempt to design a partial denture, by simply looking into the patient's mouth, and deciding what can be done, as it would be for an engineer to erect a bridge without first surveying the site, making proper designs on paper, and plans and models of the work.

I am often asked to arbitrate disputes between dentists and patients and in almost every instance it seems to me that the patient has become dissatisfied because the dentist has promised too much, or has been compelled to make more extensive, or more expensive work. I am stressing this point of study models, because I feel that until we follow the procedure of the orthodontist, we will constantly be in hot water. These models also make a good record of the case, and if later the dentist is so unfortunate as to be sued by a patient, his case will often be presented more favorably to the jury if the original model can be shown.

The study models should be kept until the case is finally disposed of, and, if it is a particularly difficult or interesting one, it can be filed for future reference. White pasteboard boxes can be purchased at Dennison's, together with little black numbers which can be glued on the boxes. These make good containers for models. An index is made and the case is readily found when wanted. (Fig. 19.)

Technique for Face Moulds.

Very often the patient has a peculiar irregularity in the labial teeth which we would like to reproduce in the denture. Face moulds of the labial surfaces of the teeth are taken, and filed with the study models.

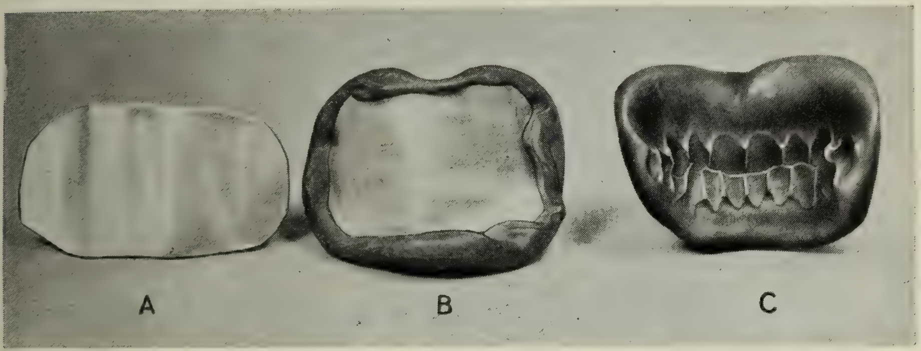


Fig. 20. A. Pewter for face mould. B. Compound applied to the pewter. C. Impression.

The face moulds are very simply made. A piece of pewter, which is known to the dental trade as "Ash metal," or "Giffen metal," is cut into an oval shape which would cover the anterior teeth from cuspid to cuspid including the upper and lower teeth. (Fig. 20 A.) A piece of compound, about a half of a sheet in size, is heated and placed on one side of this metal. Heating it in the alcohol flame will make it adhere to the metal and the edges should be covered. (Fig. 20 B.) This is placed in hot water to equalize the heat, and laid on the glass working surface of the bench, the metal toward the glass, for a few minutes until it begins to harden. The surface on which the impression is taken is then heated in the alcohol flame and dipped in warm water to equalize the heat. This gives a hard back with a soft surface on which the impression is taken and prevents the compound from crawling. The patient is requested to close the teeth, either with the teeth edge to edge, or in centric occlusion, and the compound is placed against the labial surfaces of the teeth. The lips are pulled over the mass of compound and the patient requested to compress them. When it has chilled sufficiently to prevent movement, a stream of cold air is directed against the sheet of metal. The patient is then requested to open the mouth and the impression is removed and chilled in ice water. (Fig. 20 C.)

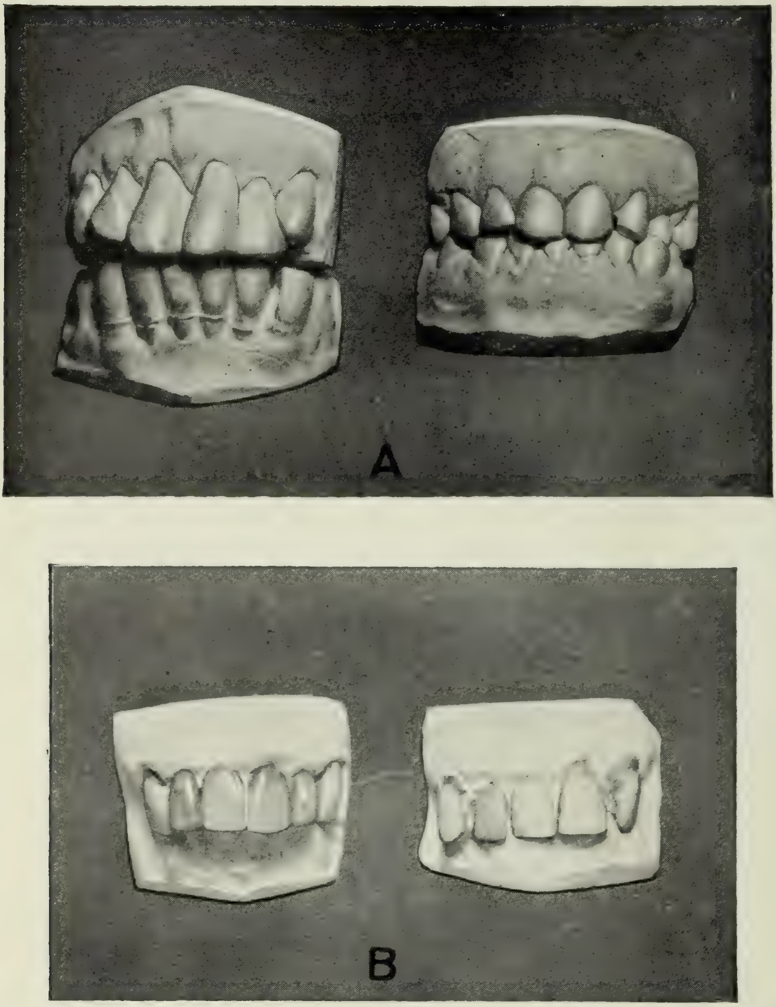


Fig. 21. A. Models poured in plaster. B. Models containing extracted teeth, or bridgework.

It is generally advisable to take two of these face moulds; one is poured in a white plaster (Fig. 21 A) and the other is retained until the teeth are extracted, and the natural teeth are placed in the impression and a model poured. (Fig. 21 B.) The nicest way to pour these models is to box them. A strip of pink or yellow wax is cut about an inch and a quarter in width wrapping it around the edge of the impression and sealing it with a hot spatula. (Fig. 22.) This forms a cup, the bottom of which is the impression. The plaster is carefully poured in, to prevent air bubbles from forming, and is allowed to harden. The wax is stripped off the sides. the modelling compound removed, the model trimmed to give it a neat appearance and the name of the patient is printed on it in lead pencil. This model will help greatly in the selection of teeth. If a single tooth is to be extracted, the plaster tooth may be cut from the model and the artificial one substituted to see if it is of proper size.

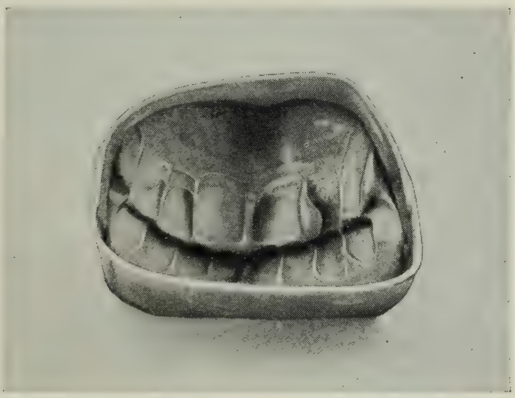


Fig. 22. Impression of the faces of the teeth, boxed ready to be poured in plaster.

This applies only to the anterior teeth, but if a case is presented with great irregularity in the posterior teeth, due to the extrusion of the same, or some great malocclusion, two study impressions are made of the whole mouth; one is poured in plaster and the other retained until the teeth are extracted. The extracted teeth are placed in the impression, it is boxed with wax, the model poured, separated and trimmed, and the name of the patient placed on the side so that it will not be concealed by the plaster if it is later placed on an articulator.

Study Models on Anatomical Articulators.

If the case is of a very extensive nature, it is essential to mount the study models on an anatomical articulator, by means of a face bow. In many instances, if the models are held in the hand, we do not see what takes place under the movements of mastication, and we might retain teeth which otherwise we would be inclined to extract.

It is not necessary to use a complicated articulator. The Stephan, the Grittman, the Gysi-Simplex, and the Monson are all excellent. The first mentioned is as simple and inexpensive as a plain line articulator, but has provision for the use of a face-bow.

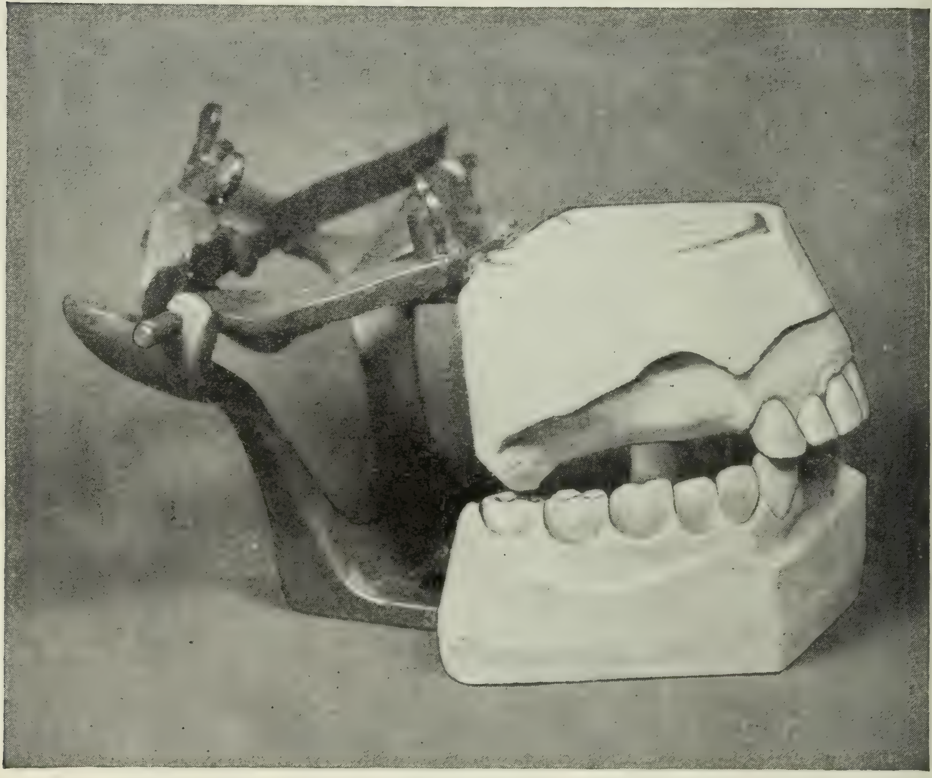


Fig. 23. Models mounted on Stephan articulator, showing the necessity of surgical removal of the tuberosity.

Importance of the Face-bow.

If you should be lead to mount models on an anatomical articulator without the aid of the face-bow, you would be making one of the greatest mistakes possible. I have often explained that a plain line articulator which has provisions for using a face-bow, would give better results than a case mounted on an anatomical articulator when a face-bow is not used. Many dentists argue against the face-bow because its use needs too much time; but if a dentist takes more than five minutes to adjust a face-bow, he is wasting time. Many say that they can guess at the position, but certainly the face-bow reduces the error of mounting on an articulator to a few millimetres, where a guess may cause the dentist to mount the case too far out, or too far in; too far to the right, or too far to the left. Or the plane of occlusion may be entirely different from what it is in the mouth. It is a fallacy to try to mount a case, as suggested, on the Gysi-simplex articulator, that is, using the marks on the articulator to establish the plane of occlusion. If the student cares to do careless work, he may just as well go back to the plain slab articulator, which is made by just fitting the two models together on a slab of plaster, so that they can be lifted off separately when he wants to set up his teeth. If he hopes to give the patient any comfort, he must apply more scientific methods and while I do not believe that the complicated articulators are necessary for mounting study models, yet I do think that we should use one which reproduces a few of the more essential movements of the mandible.

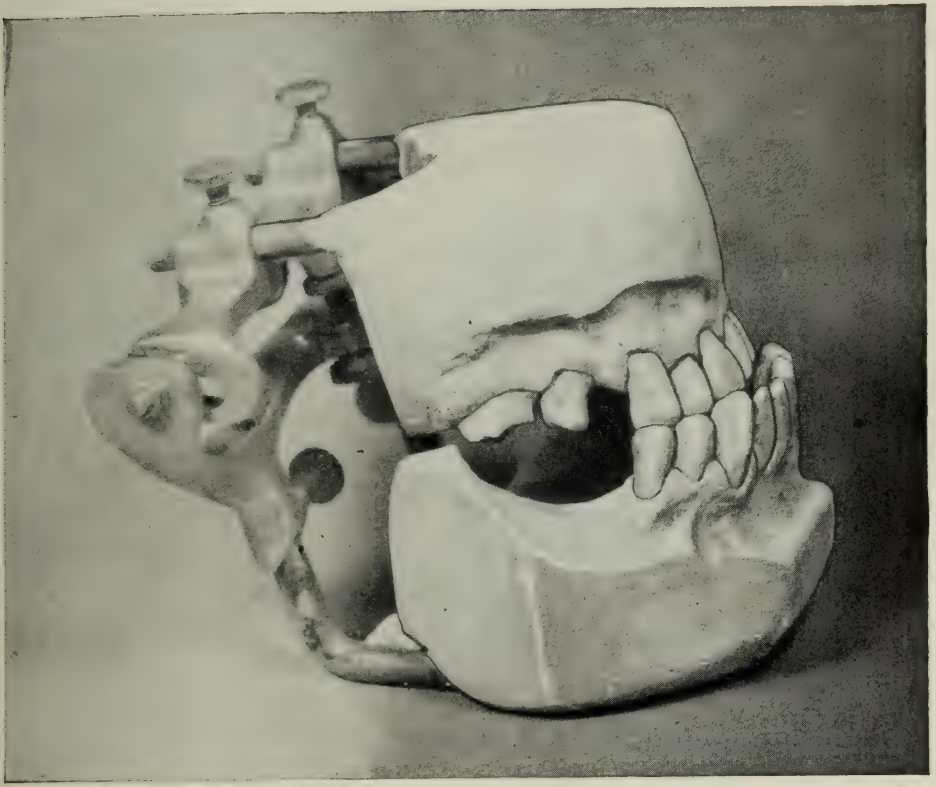


Fig. 24. Models mounted on the Grittman articulator.

Advantages of an Anatomical Articulator.

This point was brought home very strongly to me in the early part of my practice by three concrete examples. Dr. Grittman, in his lectures in the University of Pennsylvania, was in the habit of telling his students the following: "If it is essential to use an anatomical articulator in full upper or lower dentures, to overcome excessive stresses when the mandible is moved and thus prevent the suction being broken in the upper, or the lower plate being moved out of place, how much more essential is it to mount your partial cases, or even your bridgework, on the articulator so as to plan to prevent the abuting teeth from being extracted by the forces of mastication when they are applied to the teeth." I remember he often said, "If you are making a set of teeth for a Sphinx, use a slab articulator; if you are making a set for a dog or a cat, that uses only the open and shut motion in biting, use a plain line articulator; but if you are making a set of teeth for a human being, use an articulator which will reproduce a few of the many motions of the mandible."

Patients become accustomed to dentures and bridges made on plain line articulators, simply because they eliminate lateral motions of the mandible. If they do not eliminate them, the dentist will be compelled to do excessive grinding in the mouth, or the bridge will become loosened with its attached teeth. From a financial standpoint, if it is profitable to use an anatomical articulator on a cheap plate, it certainly would be more profitable to use it when constructing an expensive denture.

The second reason for using an anatomical articulator was prominently seen in our work at the University of Pennsylvania's clinics and those of the Blockley Alms House. I believe that we did practically all of the broken jaw work that was done in Philadelphia. These clinics established a reputation for this type of work and most of the hospitals sent their patients there.

In the early days, when we were using the old fashioned Gunning splints, which compelled us to open the bite, we noticed that the majority of cases which were mounted on the plain line articulator without a face-bow, had faulty occlusion after the splint was removed. Either the posterior teeth did not come into occlusion, or, what was generally the case, and a much worse condition with which to deal, they struck entirely too hard, necessitating excessive grinding. This could only be accounted for by the fact that the models were mounted on the articulator without a face-bow, and, as the bite was opened, it was opened on an arc of a smaller circle than existed in the patient's mouth.

While apparently we were setting the jaw in its correct position, actually we were not; and when the splint was removed, and the teeth of the lower jaw were brought into contact with those of the upper, the posterior teeth struck too soon, or not soon enough, in a direct relation to

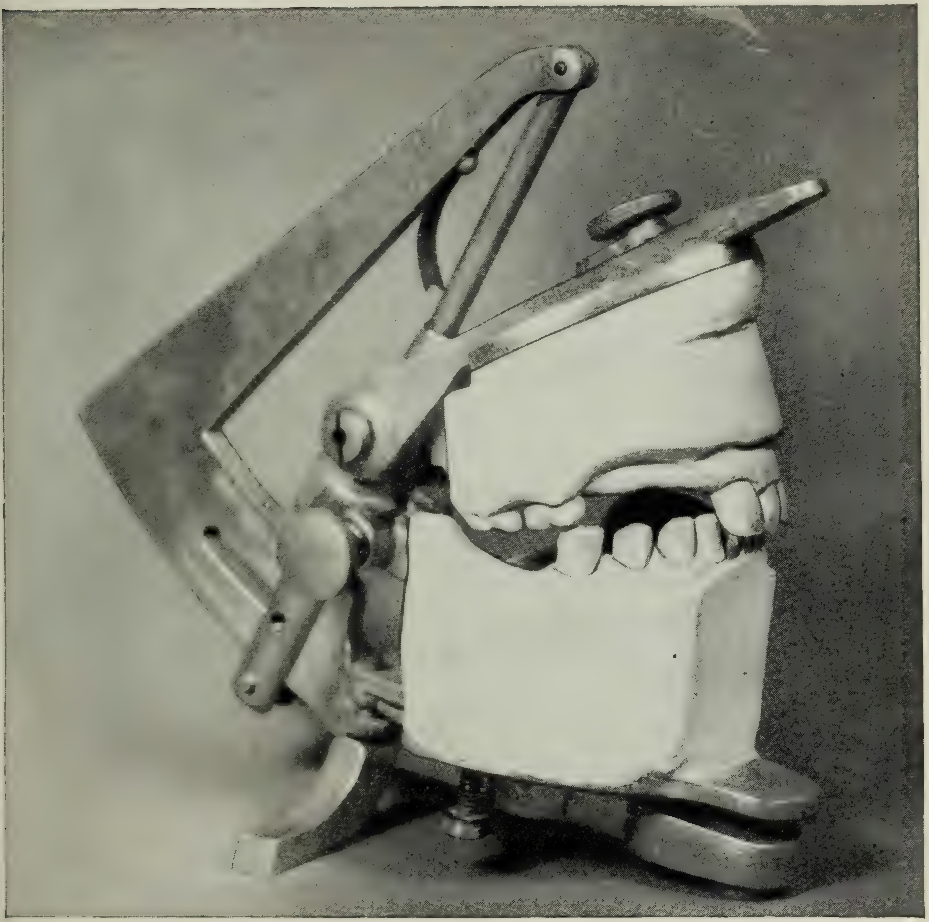


Fig. 25. Models mounted on the Monson articulator for study of the opening of the bite.

the mounting of the models, as to whether they were mounted too close to the articulator hinge, or too far away. After the practice of using the face-bow was established, this trouble entirely disappeared.

The third example was when I was called in consultation with a prominent bridgeworker, in a nearby city, to determine what was wrong with a beautifully constructed bridge of the Peeso type. When the patient would bite in centric occlusion, the bridge remained in place, but biting on one side caused it to rise on the opposite side. The dentist was about to tear the bridge to pieces and reconstruct it, thinking there was not enough friction, or hold to the attachments. When we took impressions of the bridge, mounting the casts with a face-bow, on an anatomical articulator, it was discovered that all that was necessary was to build the lingual cusps higher. As these were made of gold, castings were made and soldered on and the trouble entirely disappeared. I know this bridge is still being used today and an otherwise beautiful piece of work would have been destroyed if the face-bow had not been used.

Study Models on Anatomical Articulators.

The three illustrations (Figs. 23, 24 and 25) show study models of cases which it would have been impossible to satisfactorily diagnose if they had not been mounted on anatomical articulators.

The first (Fig. 23) is mounted on a Stephan articulator and required surgical treatment before the plate could be made. If the dentist had been led to make his diagnosis without mounting on an articulator, he would have found it impossible to put the denture in the patient's mouth, as the lower teeth came into contact with the tuberosity. If a single upper model had been taken this would not have been noticed, or if the models had been held in the hand, no doubt an error would have been made, on account of the lack of occlusion on the opposite side of the mouth. The dentist would naturally have brought these teeth together and more space would have been left between the tuberosity and the lower teeth than actually existed. This articulator does not require any special knowledge of mathematics. Neither does the Grittman, which is shown in Fig. 24 with a case mounted on it. Here again an anatomical articulator was a necessity, as only two teeth were in occlusion, these being bicuspids. No one can hold models in the hand and determine with any degree of accuracy conditions existing in the mouth.

The third case (Fig. 25) is an extreme one requiring opening of the bite and for these I always use the Monson articulator, because it is the only articulator I have ever found which permits extreme opening or closing of the bite. If at any time, as it was in this particular case, you are uncertain of the procedure, it is a good plan to set up some teeth on the study models, and build up with inlay wax where you intend to open the bite with inlays, or cut off the extruded teeth where you intend to grind down (Fig. 25), marking these with blue pencil so that you will not mistake slight wear of the plaster for parts that have been ground off. This is not necessary in every case, but for the one in Fig. 25, three men had attempted restorations and the mouth was steadily going to destruction. The appliance has been worn by the patient for about a year, and the trauma has apparently been arrested in all but one tooth.

CHAPTER IV

Impression Materials and Sectional Compound Impressions

Impressions of plaster, compound, wax, or combinations of any two, or all three have their place in dentistry and one in some men's hands works better than others.

Impression Materials.

We should select a standardized material, one that always acts the same under given conditions. Compound is par excellence in this respect. The materials entering into its composition are standard to certain chemical tests, and when they are mixed in certain proportions, react to heat in a definite manner. They soften and harden to a definite extent for each temperature. Temperature of water is easily controlled so that the dentist knows that if he works with compound at certain temperatures, he can obtain certain results. If he does not get the results expected, he knows that the personal element entered into the failures.

Wax.

Waxes are not as constant in their composition, especially those made with beeswax as a base, as each batch slightly differs from every other. There are waxes, such as the Everett's and Tompkins's waxes, which have in their make up some mineral waxes, and are much more stable in their behaviour.

Wax in general is not so easy to control as compound. It must be used in combination with other materials to give it sharpness of outline and surface. It must be applied on a compound backing. Even when taking bites, it must be supported by other substances to obtain accuracy; but it does stand second in point of usefulness.

Plaster of Paris.

Plaster of Paris probably is used by more dentists than any one material, and is the worst material in the list from all standpoints except sharpness of line, and in my experience, it does not compare with compound in this respect, if equal skill is used in handling the two materials.

Plaster of Paris has the following disadvantages, named in the order of their importance to the dentist:

Lack of stability; it refuses to maintain its form; atmospheric changes affect its bulk and hardness.

It expands rapidly in its initial set and as it dries, it contracts. This can be shown by making a mix and pouring it into a thin glass beaker, and setting a wooden screw in it before it hardens. First it will crack the beaker and then, as it dries out, it will contract and, by pulling on the wooden screw, it will be seen to be loose in the glass.

It loses toughness and gains in brittleness as it dries out.

No two men can get the same mix of plaster from the same barrel of plaster, unless elaborate precautions are taken to obtain pure distilled water, weigh it and then use the same temperature of water, the same quantity by weight of setting material (potassium sulphate), the same quantity by weight of plaster, and then mix it in a machine and not by hand.

This statement may seem like an exaggeration, but it can be proven by anyone who cares to try the experiment. Each batch of plaster is different if the gypsum comes from separate mines, or if it comes from different parts of the same mine. No two mills can calcine it the same. It varies at different seasons of the year, due to atmospheric conditions, and the plaster at the top of a barrel never mixes the same as that at the bottom. Various separating materials must be used to separate the cast from the impression and these detract from the sharpness, and, by actual measurement, this separating film varies from fifteen thousandths of an inch to one one-hundredth of an inch.

In partial impressions, in almost every case, small pieces of plaster are lost and to replace them wax must be used, or plaster painted in the space, which makes the dentist only guess at the shape of the lost section. Interproximal spaces between the teeth, which are important in mesiodistal clasps, cannot be reproduced.

Saddle compression cannot be obtained.

Additions cannot be made to correct an impression.

Muscle trimming cannot be done.

Much of the plaster is not sterile, due to carelessness in handling after calcining.

Last, but not least, is the objection of the patient to the nauseating, messy plaster.

While it takes less time to take a plaster impression, it requires more time to piece it together, prepare it for pouring, separate the impression from the cast and fit the finished denture, because the material which has been forced into the undercuts must be removed with a file, in a very inaccurate manner, so that the short time required to take the impression, is more than offset by the time consumed in the other operations.

It has been said that plaster is the ideal material for taking impressions of teeth, while compound serves best for taking the impressions for the saddles. This I do not believe to be the case. After having used plaster exclusively for at least ten years, and that in association with Dr. A. DeWitt Grittman, who took as fine a plaster impression as any dentist in America, and even after being associated with him in the teaching of it, I recognized its limitations, especially in partial cases and I now use modelling compound.

I believe that our early failures in modelling compound technique were due to the fact that we used high heat compound, one softening above 150° Fahr. and also attempted to take these impressions by the closed mouth method.

Mr. Samuel Supplee, who has been one of the men most responsible for developing a good compound technique, told me that the closed mouth method, which he developed, is too difficult for beginners, except in the Class I cases. This has also been my experience. While I use the sectional method entirely, I do not use the closed mouth method.

The dentist who has no assistant, can take the first portion of his impression, by the open mouth method, and then build compound on the bottom of the tray, in such a manner that the patient can hold the first section of the impression in his mouth by firmly closing his teeth upon it, and then the dentist can take the other sections without the aid of an assistant, as shown in Figs. 44 and 45.

Impression Compounds

In my practice I have used Modelrite and Kerr's Compound. Some men get an excellent result by kneading together the black compound of Hall, manufactured by S. S. White, and English white compound. This is a matter of personal preference. I prefer Kerr's because the manufacturer supplies a complete line of sticks, cones, and wafers. There are other good compounds such as Dresch's and Alston's.

Compound which must be heated above 150° Fahr. must be used too hot to be borne by the patient, and takes too long to chill. The best compound to use must work nicely at 145° Fahr.

It should be heated in water which contains no free alkali, for instance, soap, or bicarbonate of soda, as these substances cause the compound to become slippery and prevent its coherence when it is kneaded. Dry heat should never be used, unless it is obtained from an alcohol burner, and

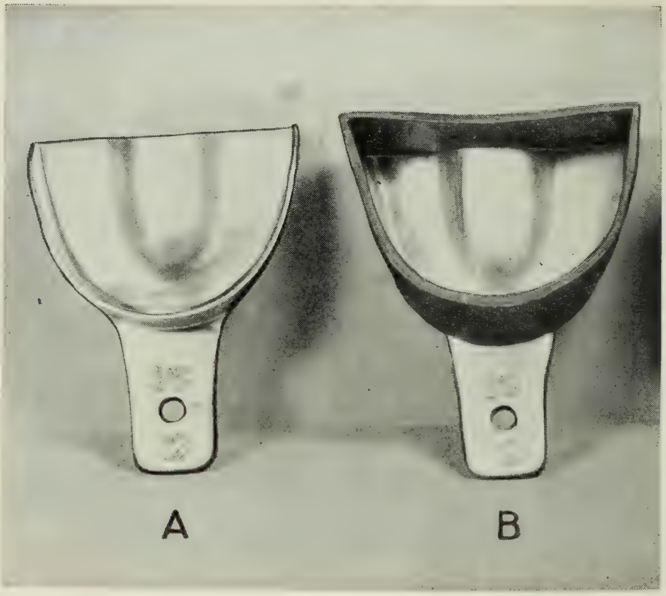


Fig. 26. A. S. S. White tray No. 12 upper. B. Boxed for pouring model.

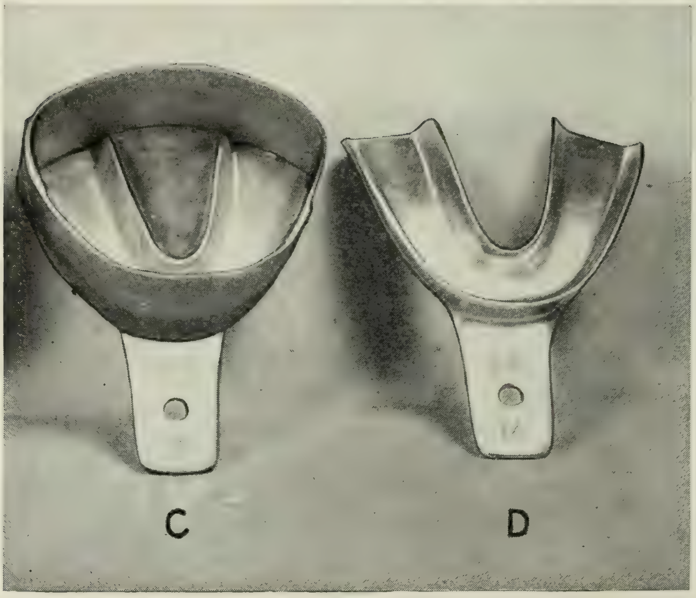


Fig. 26. C. Boxed for pouring model. D. S. S. White tray No. 14 lower.

whenever it is used the impression should subsequently be dipped in water at 145° Fahr. to equalize the heat and prevent burning the patient.

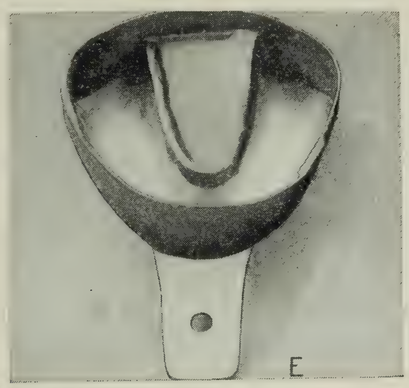


Fig. 26. E. Lower tray waxed with deeper lingual flanges.

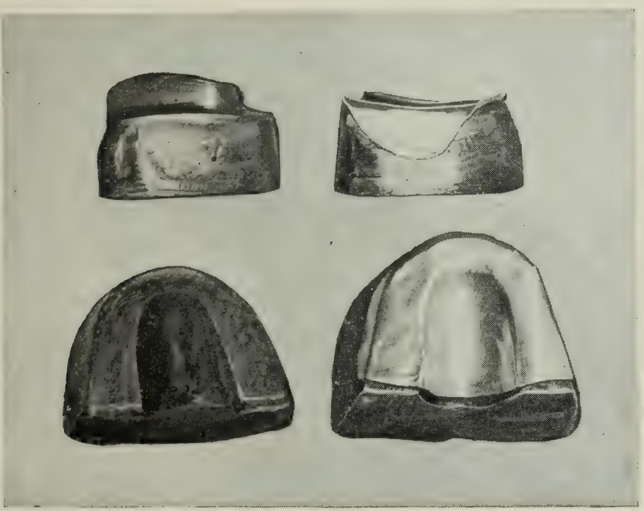


Fig. 27. Dies and counter dies with tin patterns swaged and cut to shape.

Home Made Impression Trays

We must provide ourselves with impression trays. I believe I have tried every kind of impression tray that was ever manufactured, each having some peculiarity which unfitted it for the work. I now make my own out of 22 gauge soft aluminum, which can be purchased from the wholesalers in sheet metals, or from the radio manufacturers. It is so cheap that trays can be thrown away after each using. I found that the S. S. White No. 12 upper and No. 14 lower trays are the most useful in the

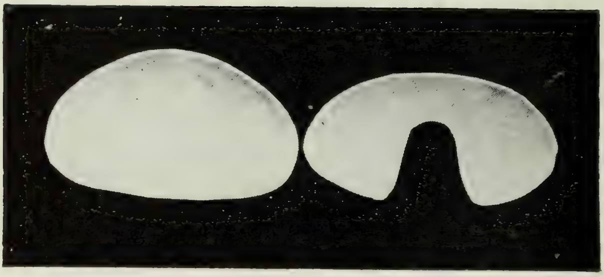


Fig. 28. Cardboard templets made from tin patterns.

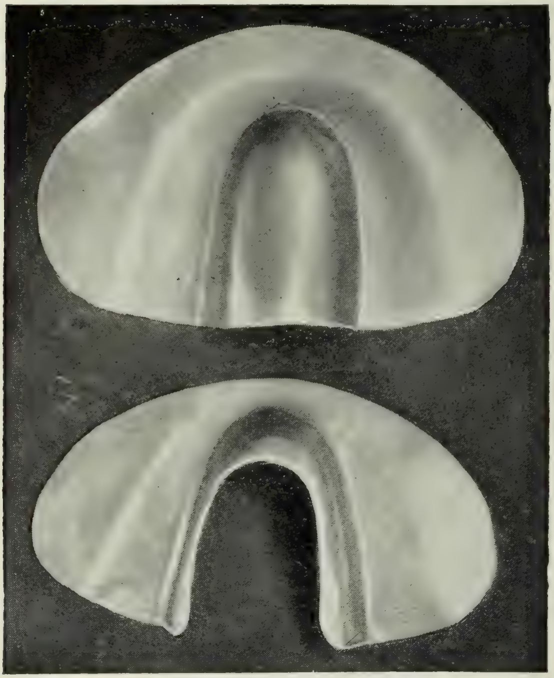
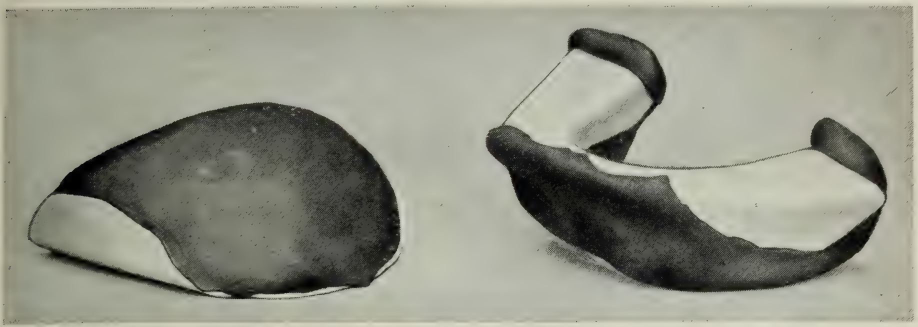


Fig. 29. Trays swaged, wings left for bending with pliers.

greatest number of cases. Hence we took these trays, boxed them with carding wax, and filled them with plaster. When each had hardened, it was shaped at the proper taper to allow a sand mould to be made, and zinc was poured into this sand mould, making a zinc die. For the upper tray a zinc counter die was made to cover what would correspond to the palatal and lingual surfaces, but not the buccal and the labial. (Fig. 26 A, B, C, D, and E.) Sometimes in the lower tray it will be necessary to build the labial flanges deeper, as they are not deep enough to hold the modelling compound in most cases. The model however can be poured and deepened later by cutting out the plaster, though this makes more work. The counter die is made to cover the occlusal and the lingual flange. (Fig. 27.) A pattern is made by swaging a piece of tin foil, flattening it out, and reproducing it on a heavy piece of cardboard. (Fig. 28.) These pieces of cardboard are retained, laid on the soft aluminum and a pattern outlined with a sharp instrument. They are really small templets, or patterns, and if they are laid down carefully, a great deal of material can be saved. The trays are then swaged (five dozen of these trays can be swaged in an hour) and the buccal side wings are left until we are ready to take the impression. They can be bent to shape with the fingers, or with a pair of flat pliers. (Fig. 29.) The tray is then cut to the shape desired, all of which takes not more than five minutes. After the tray has been used, the compound may be removed, the tray sterilized and it may be used for the next impression, or thrown away as the operator may prefer.



A. B.

Fig. 30. Upper and lower trays, with compound ready to take impressions for study models.

Sectional Compound Impressions

In taking an impression the position of the patient is the same for each material used. The patient should be made comfortable in the chair and covered with an apron or towels. Any salivary calculus which is on the teeth should be removed and the teeth polished. Any large cavities which are to be filled later permanently, should be filled with temporary cement. The mouth should be sprayed with an antiseptic solution. Vaseline should never be used to coat the teeth, as this spoils the sharpness of the impression. It is sufficient that the mouth be moist.

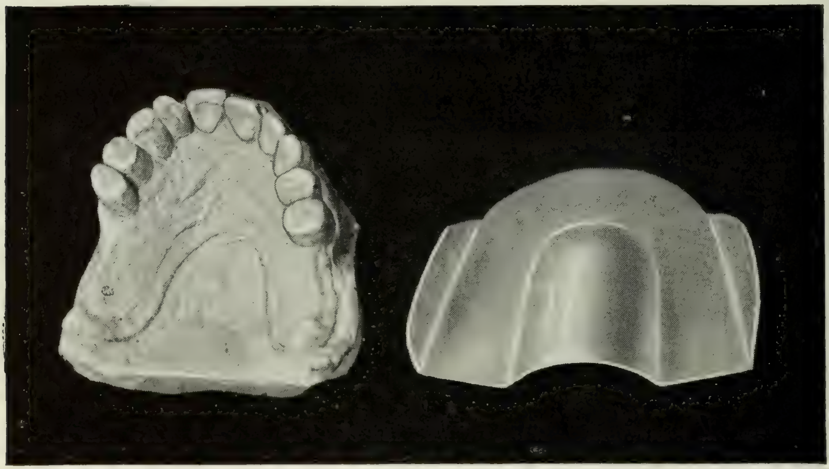


Fig. 31. Upper study model outlined in pencil, or with a sharp instrument, and tray prepared of suitable size for this particular case.

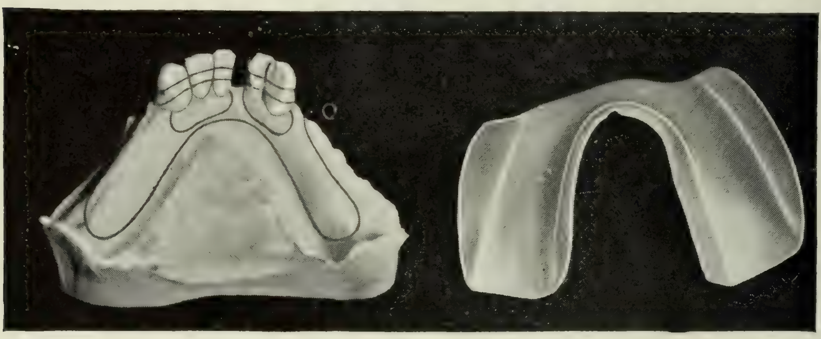


Fig. 32. Lower study model, outlined in pencil, or with a sharp instrument, and tray prepared of suitable size for this particular case.

Technique for Upper Impressions.

For an upper impression about a sheet and a half of modelling compound is placed in the heater and brought to the proper temperature. It is kneaded into a ball until there are no lines and bubbles of water in it. It is then placed in a tray shaping it so that its highest point is at the center of the palate. (Fig. 30 A.) The tray should be cut in such a manner that it comes to the buccal-occlusal edge and incisal edges of the teeth, and wings should be left where there are to be

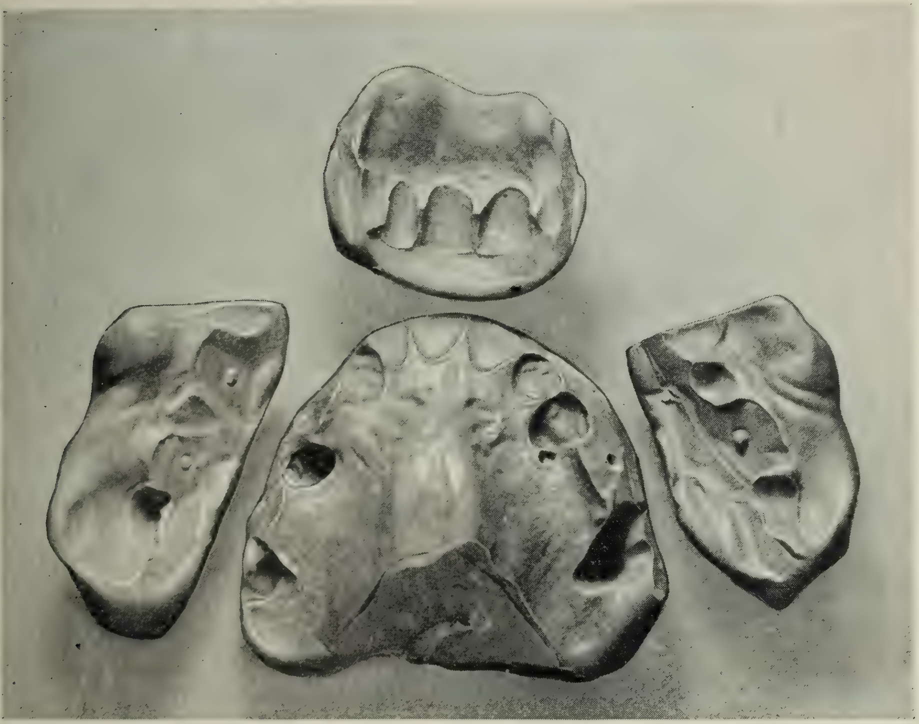


Fig. 33. A difficult Class 2, modification I, impression that required four sections. Note sharp separating lines.

extension saddles. (Fig. 31.) This is best done by placing the tray upon the study model and outlining on it with a lead pencil, or a sharp instrument, where it is to be cut. (Fig. 32.)

The underlying principle of sectional modelling compound impressions, is that the first portion of the impression must cover all that is to be covered by the saddle; also the lingual and occlusal surfaces of the molar and bicuspid teeth, and the lingual and incisal surfaces of the anterior teeth. (Fig. 33.) Where a saddle is to extend between two teeth, the impression is terminated at the top of the ridge between the teeth. The material is so manipulated that the undercuts are reduced. This manipulation of the impression saves us later the fitting of the plate to the mouth by filing, and is much more accurate.

It is also advisable, if a study model has been made, to shape the modelling compound blank upon the study model before it is placed in the mouth. (Fig. 34.) The study model is thoroughly wet and the compound, which is placed in the tray as previously described, is forced on the study model, care being taken not to force the tray too close to the occlusal or incisal edges of the teeth. At least three-eighths of an inch of thickness of compound should be left to allow for future working.

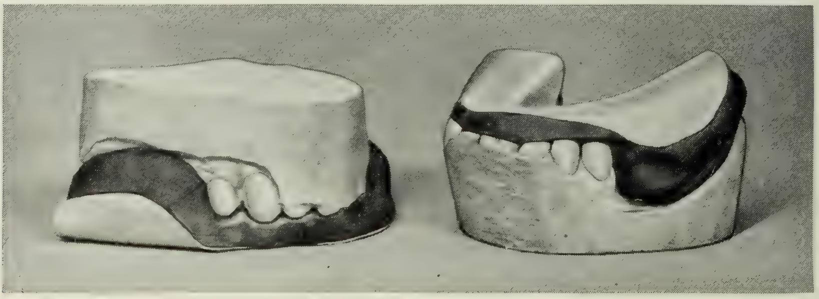


Fig. 34. Trays and compound approximately adjusted on study models.

The study model should have been outlined as to where the plate is to extend, and if these outlines are gone over with a sharp instrument (Fig. 31) a beading will appear on the impression, so that the blank can be cut down to within a quarter of an inch of the extreme limits of the saddle, making much less bulk of material to be placed in the patient's mouth. This can all be done before the patient comes to the office.

In taking the upper impression, the chair is lowered until the patient's mouth is on a level with the operator's elbow, and the operator stands back of the patient to the right side, as in Fig. 35. The patient should be seated in an upright position, and not leaning backwards.

The modelling compound blank is taken off the study model; any small pieces of plaster which adhere are washed off. The impression is dried with a blast of air from the cold air syringe or, if you have no syringe, small dental napkins may be used. It is important that the impression should be dried before the next operation.

We now take the mouth blowpipe and heat the surface of the impression with a large brush flame, going down into the impression of the teeth with a more pointed flame, such as is shown in Fig. 36. A deep cut is made towards the heel, which indicates the depth to which the surface of the compound should be softened. A fine pointed flame is required at this point, just as it was about the teeth, (Fig. 36) in order not to soften the compound beyond the line. If any moisture is adhering, the compound will bubble, leaving a roughened surface, which cannot be eradicated without heating the entire mass of the compound and kneading it over again. Hence the need of drying the surface. We attempt to

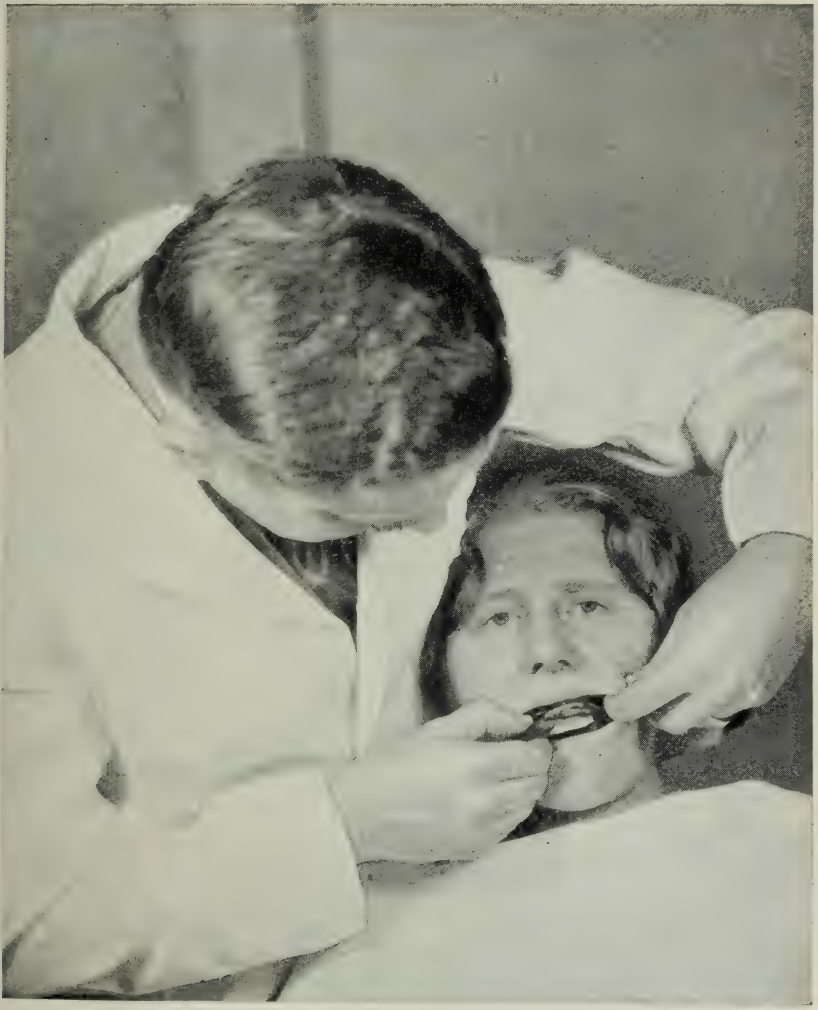


Fig. 35. Position of dentist and patient when taking upper impression.

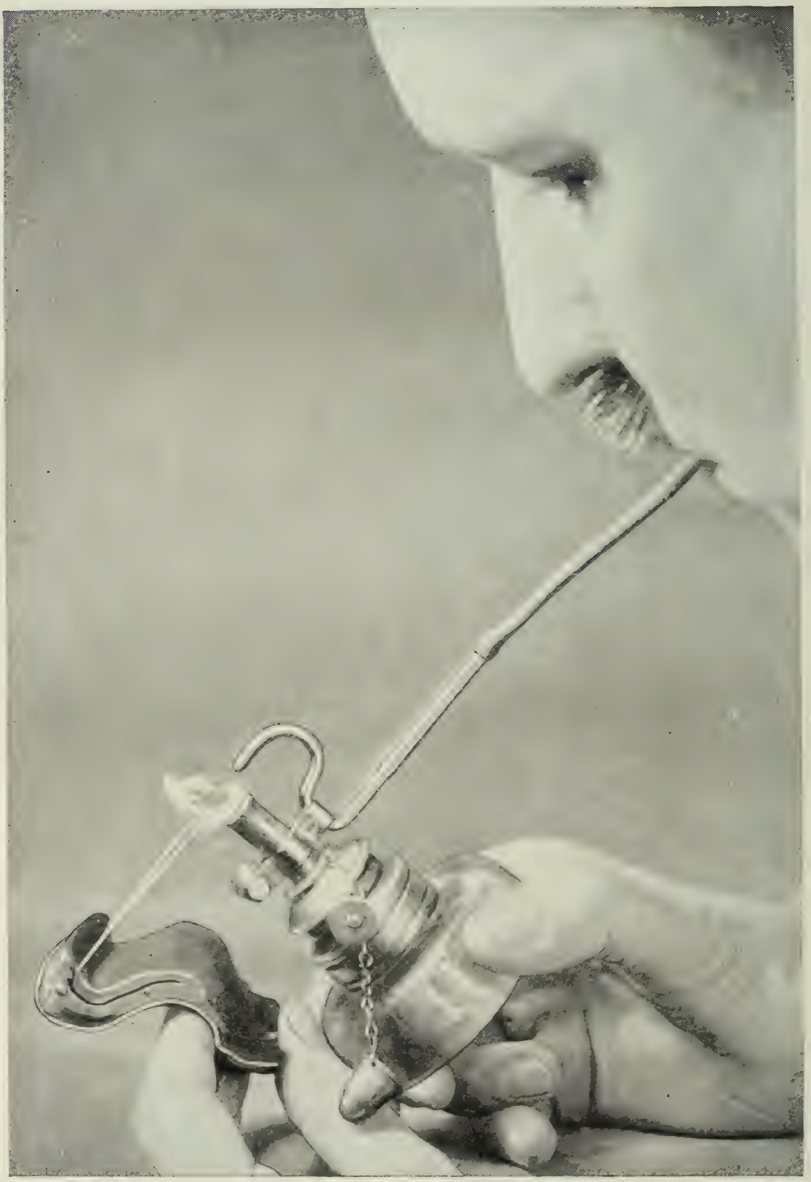


Fig. 36. Reheating impression on palatal surface. A brush flame is used for the main part of the surface, but a pointed flame, as in the illustration, is used about the teeth and along the heel.

heat the surface of the impression to an even depth, leaving the bulk of the compound hard, giving us a softened surface with a hard back, which, when forced into the mouth gives us a much more accurate impression than if the whole mass of compound were heated evenly throughout.

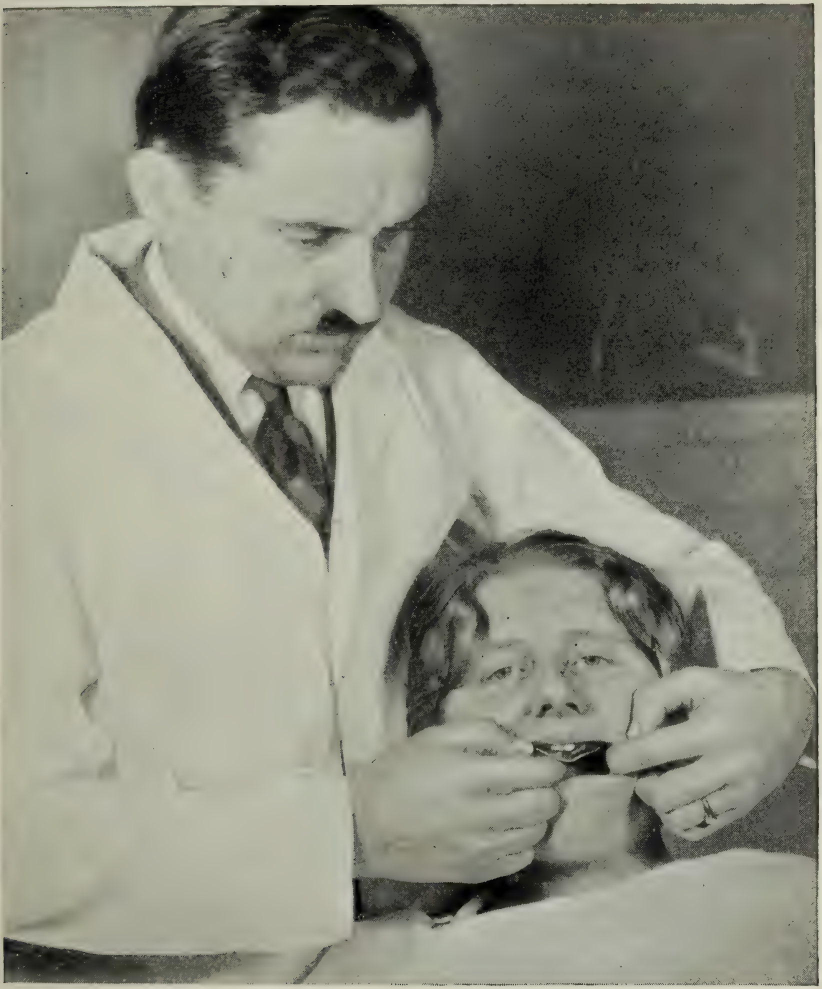


Fig. 37. Holding the impression in place during muscle trimming.

The impression is then dipped for about fifteen seconds into water at 145° Fahr. It is then brought to the patient's mouth, the thumb and forefinger of the right hand holding the tray. The right side of the tray is placed in the patient's mouth (Fig. 37), the forefinger of the left hand pulls the cheek aside, and then the left hand portion of the tray is rotated into position. If there are to be extension saddles, the fingers are placed on the buccal sides to see that the compound is pressing against the ridge. Force is then applied by the forefinger of the right hand to the center of the tray, pressing upward and forward to an imaginary point on the bridge of the nose. Immediately, cold air from the syringe is forced into the mouth. It is best to turn the air on very slowly, so as not to frighten the patient, or the pressure should be tested against the back of the hand holding the impression, and gradually brought into the mouth.

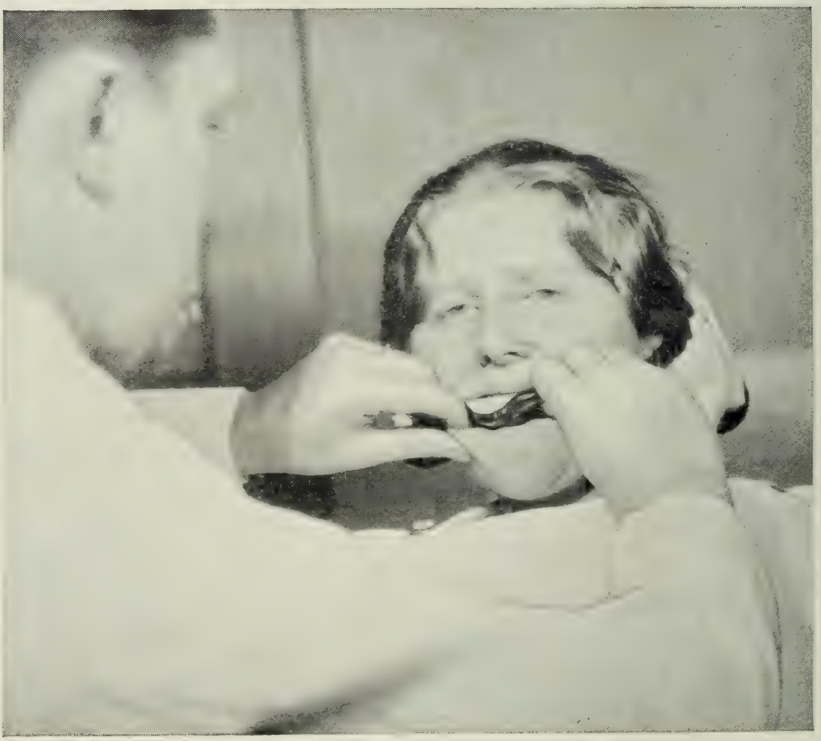


Fig. 38. Position of dentist and patient when taking lower impression.

The impression is chilled to a degree which corresponds to about the toughness of a lead pencil rubber, and, while holding it firmly in place, first the left cheek is grasped with the thumb and finger of the left hand (Fig. 37), and the cheek pulled downward and pressed inward to do any muscle trimming if there are to be extension saddles. If there are to be saddles on both sides of the mouth, this procedure must be followed on both sides, then, while still holding the finger against the center of the tray, the patient is asked to swallow several times and then to open the mouth as far as possible. This does muscle trimming on the rear of the plate. "Muscle trimming" is the accepted term used by compound workers to mean shortening of the impression by muscular action, and it is in this respect that modelling compound has the advantage over plaster in that you get an impression of the tissues, while under muscular movement, without distortion.

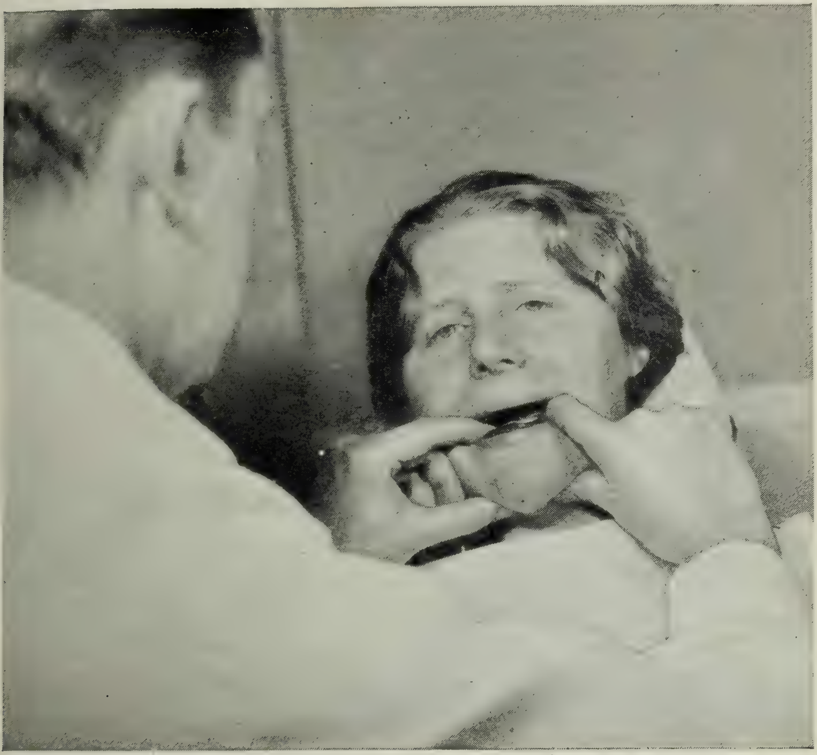


Fig. 39. Holding the impression in place during muscle trimming.

Technique for Lower Impressions.

In taking the lower impression, the patient is raised so that the mouth is on the level with the operator's shoulder and the dentist stands in front of the patient to the right side, the left side of the tray is put into the mouth (Fig. 38) and the right side rotated into position, and then, with a gentle downward and forward pressure in the direction of the point of the chin, the impression is brought to place by putting the forefingers of each hand on top of the tray, and the thumbs under the mandible, holding it firmly in place until it begins to harden. The patient is then requested to raise the tongue to the roof of the mouth and move it around in all directions (Fig. 39), which does the muscles trimming on the lingual side. If there are to be extension saddles in the lower, muscle trimming can be done the same as in the upper, but it will be necessary to hold the impression down with the first and second fingers of one hand placed on top of the tray, while the cheeks are manipulated with the thumb and forefinger of the other hand.

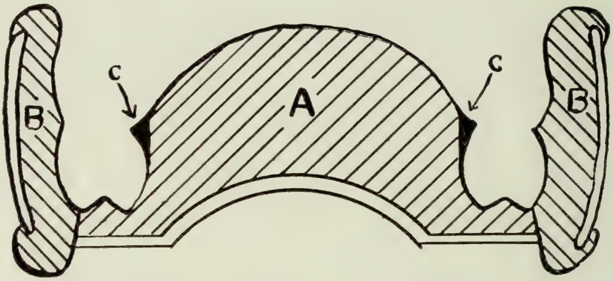


Fig. 40. Diagram of sectional impression. A. Palatal portion. B. Buccal portion. C. Spaces where undercuts are relieved.

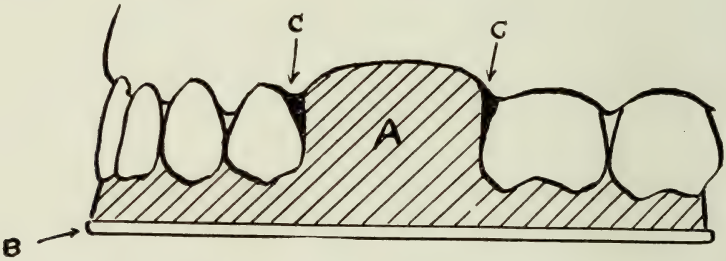


Fig. 41. A. The impression. CC. Undercuts relieved.

The impression is then chilled until it is quite hard. This can be determined by feeling with the finger nail on the incisal edge. It is slightly harder there, than on the palatal surface, which is an advantage because the next operation is the one of releasing the undercuts. *This comprises pulling the impression about one-eight of an inch away from the tissue and then forcing it back into place again. This should be done about three times, increasing the distance each time, with an interval of about fifteen seconds of pressing it against the tissue, in between.* The impression is finally released and rotated out of the mouth in the reverse manner to which it was put in, and dropped into a bowl of ice water to chill it thoroughly.

This reduces the undercuts where so desired, as shown in diagram, Fig. 40. The undercut C, in section A, of the impression, has been reduced in this manner. It also shows the buccal side of the impression B, where the undercut has not been reduced. In Fig. 41, where the teeth tip towards one another, the undercut C, is shown to have been reduced. In Fig. 42, where there is to be a saddle on one side of the mouth, the impression is lifted out on the saddle side, in the direction indicated by the arrow, rotating it around point B.

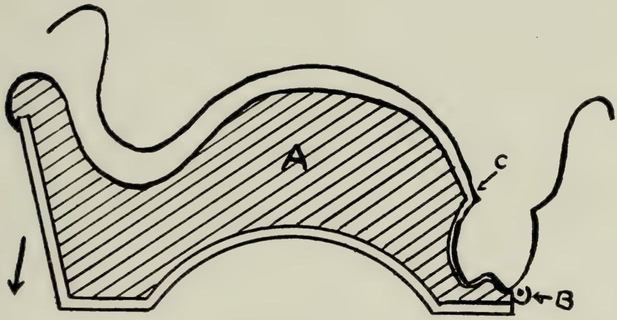


Fig. 42. Diagram of impression on case requiring saddle on one side. Undercuts at C not relieved, as it is not necessary if impression is rotated around point B.

If the model has been carefully studied the dentist can determine beforehand, when he is making his blank, which side of the impression should be removed first.

In taking a Class I impression, the back edge is dropped down before the front. In taking a Class II impression, the side which is to have the saddle should be released first. In taking a Class III impression, the side which has the least amount of locking between the teeth, or undercuts on the lingual surfaces, is released first. In taking a Class IV impression, the front is lifted before the rear.

The student would do well to procure models of the different classes and practice taking impressions thereon.

After the first portion of the impression is removed from the mouth, a sharp knife is used and the surplus compound is trimmed from the labial and buccal surfaces of the teeth, to a line where the undercutting begins. This is necessary to prevent dragging of material at these points, because on these labial and buccal surfaces we intend to fit clasps, and the contours must be produced with a great degree of accuracy. We do this by placing the first part of the impression back into the mouth after it is trimmed and observing whether it comes tightly and evenly against the teeth.

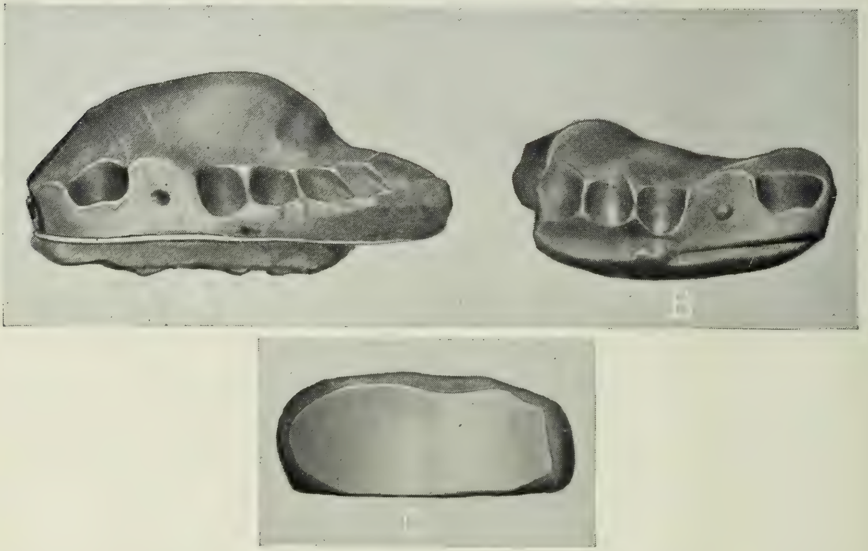


Fig. 43. Parts of sectional impression. A. Palatal portion, with compound attached to bottom of tray, when it is necessary to have the patient hold it in position. B. Buccal section. C. Buccal section showing pewter backing.

If such is the case, a piece of pewter, or air chamber metal, is cut to fit the portions of the labial or buccal surfaces, of which we desire to get an impression, and a piece of softened compound about three-eighths of an inch in thickness is applied to one side, the edges lapping around the pewter, or air chamber metal, to hold it in place. (Fig. 43.)

This pewter goes under the trade names of Ash's metal, or Giffen's metal, and is known also as No. 7 soft metal. The student may be led to use the wings which he has cut from his trays. This would be false economy, as the aluminum is not flexible enough for this purpose, as will be seen later.

It is well to allow the compound to lie on the surface of the bench for a minute or two, with the metal against the glass. This will have the effect of hardening the compound on one side, to some extent, and will prevent the soft compound from crawling. The compound is then dipped

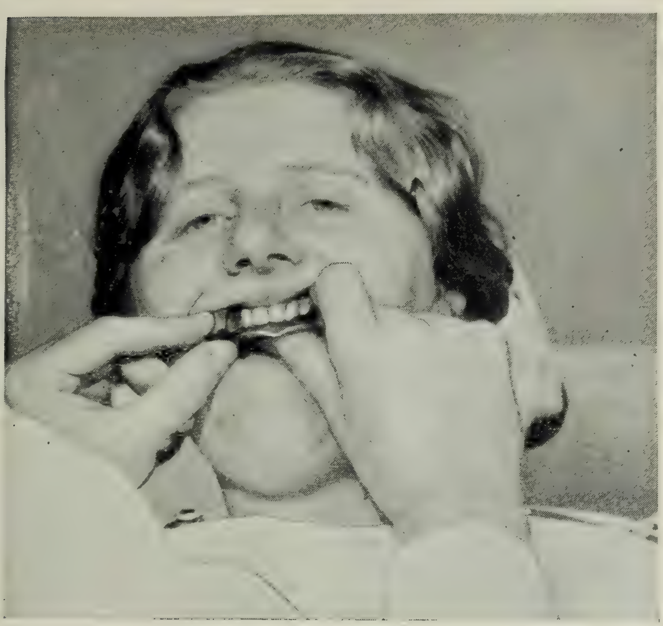


Fig. 44A. Holding upper impression in position while adjusting buccal portion.

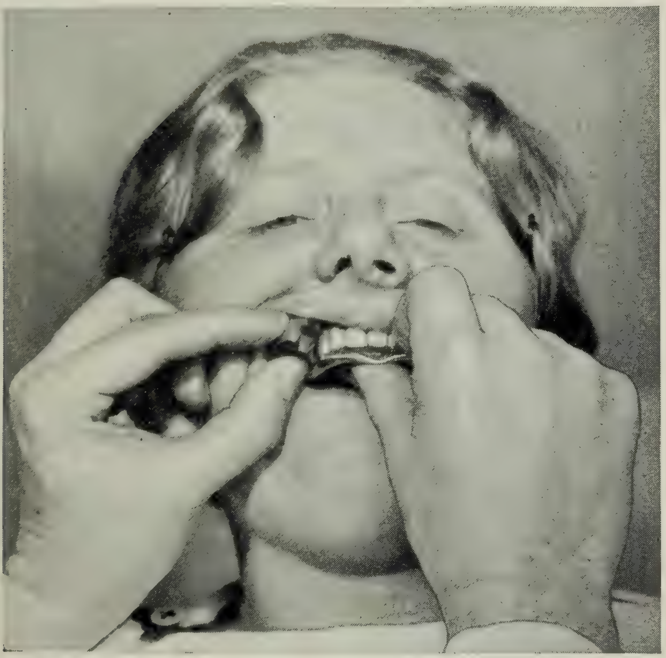


Fig. 44B. Pressing the buccal portion against the teeth, etc., to get a sharp impression.

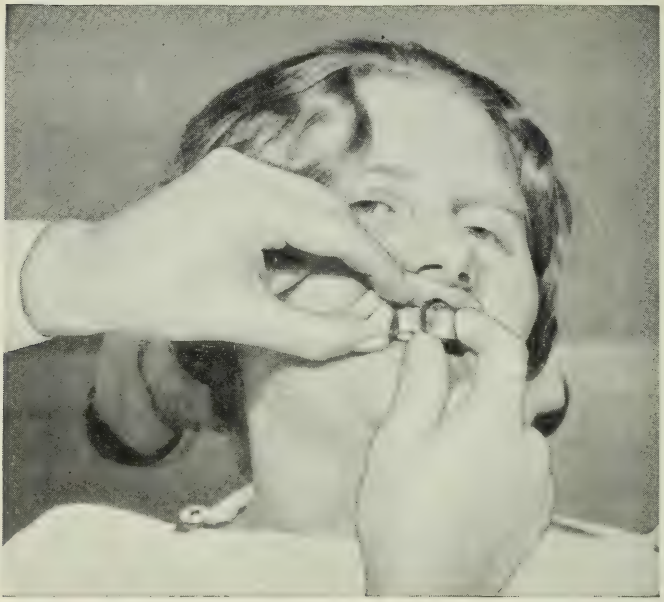


Fig. 45A. Placing labial portion against palatal and buccal sections, which have been previously placed.

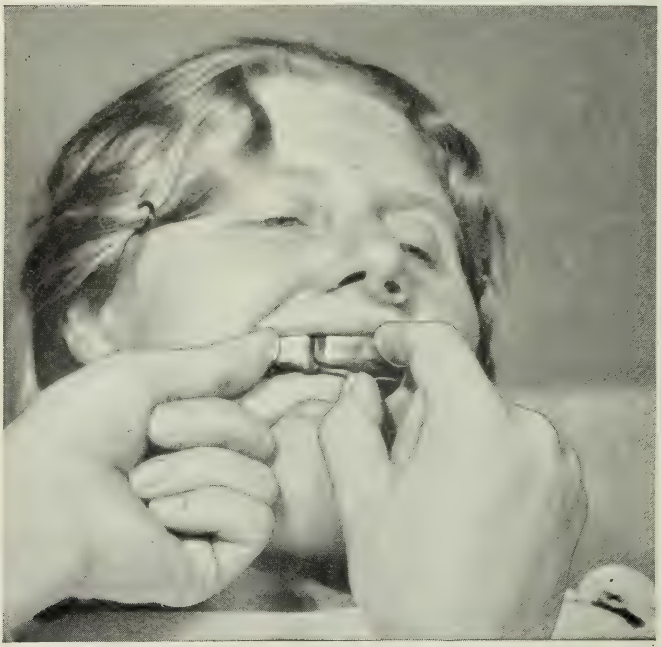


Fig. 45B. Holding the three portions while the compound hardens.

into the hot water for an instant and inserted into the mouth, the metal forcing the cheek away, while the thumb or finger of the one hand holds the first section of the impression in place. (Fig. 44A.) The first section covers the palate and the lingual and occlusal surfaces, in the upper jaw, and similar areas in the lower. After the buccal section is in position, it is gradually forced against the teeth with the forefinger of the other hand. (Fig. 44B.)

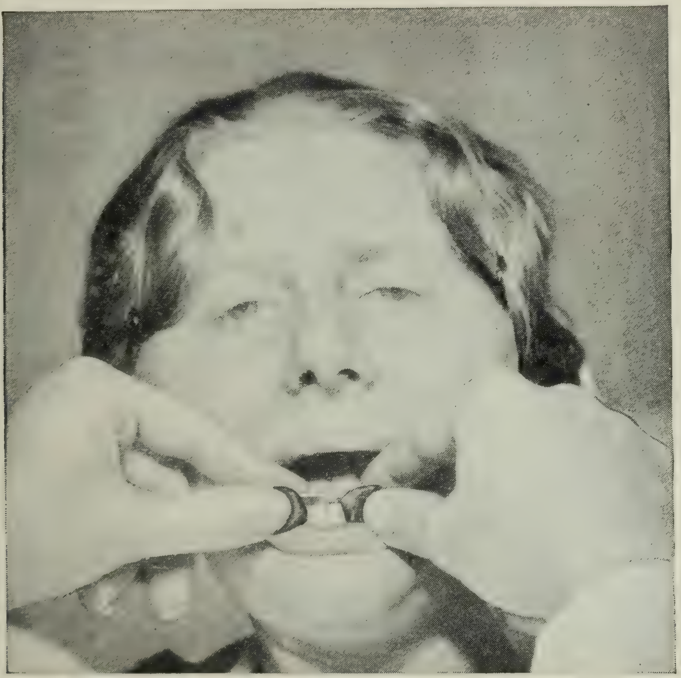


Fig. 46. Taking impression of single teeth, where clasps are to be used, as in a Class I case.

The forefinger is slid back and forth on the smooth metal, until the dentist feels that the compound, throughout its entire length, is in contact with the teeth and with the first section of the impression. It is chilled with a blast of air, or a stream of cold water, from a water syringe, and is separated from the teeth by drawing it away at right angles to their long axes. In this way we get no distortion of the buccal or labial surfaces which we are attempting to reproduce.

If it is necessary to take another section on the buccal or labial surfaces (Fig. 45A) the first section taken is cut with a sharp knife so that we have clean edges where they join together. (Fig. 45B). As a rule it is necessary only to take those portions of the buccal or labial surfaces of the teeth, which are to be covered by clasps, or when a space is present which is to be supplied by an artificial tooth and it is advisable to get the surfaces of the teeth on both sides of the opening.

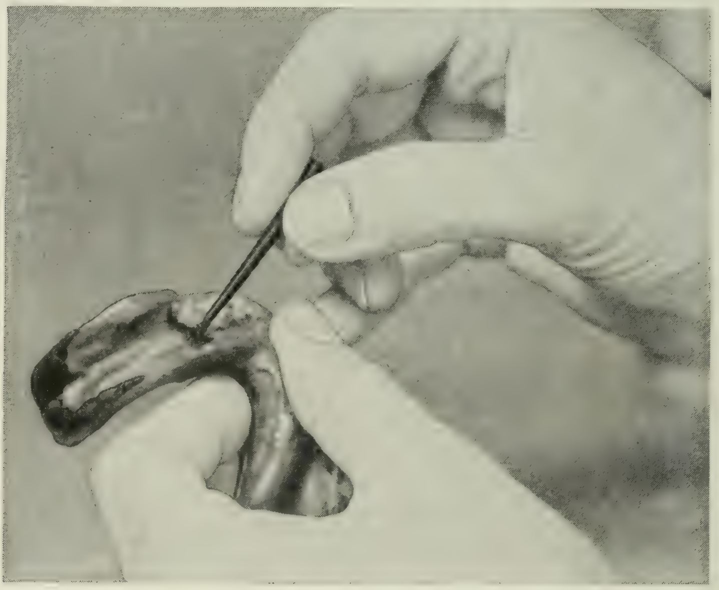


Fig. 47. Patching imperfections in impression, using black carding wax "pencil".

In the Class I cases, it is not necessary to take an impression of all of the buccal or labial surfaces of the teeth, but only of those teeth that are to be clasped, as shown in Fig. 46. A small cone of compound is formed, and allowed to harden on the glass surface of the work bench. The point of the compound is heated, dipped into water and pushed against the buccal surfaces of the teeth to be clasped. The hard base of the cone forms a matrix for the soft point and gives a very sharp impression. It is not necessary to back these small pieces of compound with pewter, if this method is followed.

Before the patient is dismissed, the buccal and labial sections should be fitted to the first portion of the impression, to make sure that the joints are all perfect and tight, and to note any discrepancies. At times, where we have a long buccal section, extending from the middle of the cuspid tooth to the third molar, to take in one piece, upon lifting it from the mouth we may find that we may have obtained a very accurate impression on one end, but not so accurate on the other. The compound should be chilled very thoroughly to retain that portion which is accurate, dried, and the portion which is not accurate should be reheated with a mouth blowpipe, dipped into water and replaced against the teeth with the accurate portion of the impression in place also.

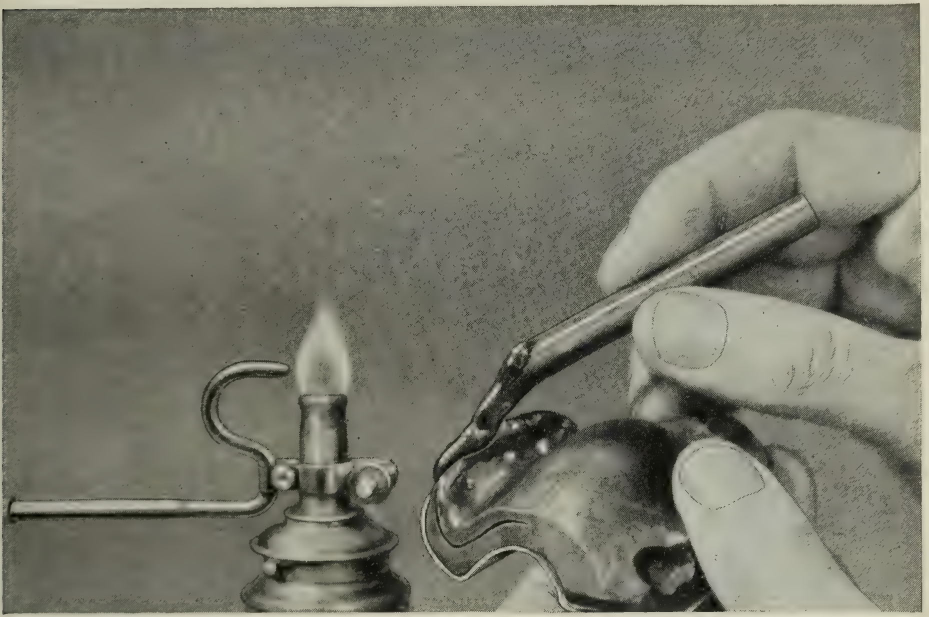


Fig. 48. Building up rim, or large defects in impression, with modeling compound "pencil".

The accurate portion of this wing will hold it in place, while the finger is placed against the inaccurate portion and pressure brought to bear. The soft pewter will yield enough to allow this to be done, whereas if we use the stiffer metal as aluminum, we would find that after pressure is released, there is enough spring to drag the impression away from the teeth. Hence the necessity for using soft metal to back the wings, instead of stiff metal. It is seldom that the wings need to be taken a second time. If all of the portions match accurately, they should be waxed together immediately and the patient dismissed.

If there are any small imperfections such as an air bubble, or a connecting line which is not accurate, it is inadvisable to add compound and reheat. Instead we take the green, or black carding wax, such as is used for carding teeth, or boxing impressions, roll it into a pencil-like form and melt it on the inaccurate spot. (Fig. 47.) This saves us the necessity of reheating the compound, and losing the accuracy of line. The black wax will perfect any slight defects very accurately. If there are any large defects, or if it should be necessary to build rims higher, it is best to add compound, melting it on with a stick as shown in Fig. 48.

The description of this technique may seem complicated, but the most difficult partial impression can be obtained in less than one half hour, and when the plate is finished, it will seldom be necessary to do more than tighten the clasps to make it fit. None of the long tedious process of grinding the teeth, on their approximating sides, or filing rubber around the teeth will be necessary. Therefore, extra time that may be spent on the impression is not lost.

The patient always becomes discouraged when the dentist needs to file and grind, in order to get the plate into the mouth. That so little fitting is required, is the best recommendation for this method. I believe that less injury is done to the remaining teeth by plates made from impressions taken by this method, than where they are wedged in and act like regulating appliances: The latter only begin to fit when they have so far forced the teeth out of position, as to allow them to rest upon the surface of the gum, and then the teeth were so damaged by the trauma as to prevent their ever becoming tight again.

CHAPTER V

The Rebasing Method of Taking Impressions for Partial Dentures

Possibly the most important step in the construction of a partial denture is the technique for obtaining proper "saddle compression."* Especially is this true where the saddles are of the extension type, which means without posterior supports. I believe that I have discovered a method of obtaining saddle compression, eliminating many of the steps and simplifying the process.

Rebasing Dentures.

It has long been the belief of partial denture workers that all partial pieces should be rebased, to obtain saddle compression, and after making a plate, the custom has been to test it to see if there is any movement, and if so the plate is rebased. Within my own experience fully eighty-five per cent of plates have needed rebasing. Dr. Nesbett rebases all his plates with wax, using a very interesting technique. It can readily be seen that if we take an impression in plaster, we obtain an accurate impression of the teeth in their relation to the ridges. But, as soon as the saddle which is resting on these ridges, comes under the force of mastication, the gum is compressed and the denture tilts. The rebasing techniques have overcome this to a great extent, and, if we accept Dr. Nesbett's statement that the rebasing prevents settling of a denture, we will have mastered one of the greatest difficulties connected with dentures.

I cannot accept Dr. Nesbett's statement in its entirety, but I do know that since I have rebased dentures, I have had much less trouble with settling, and at the same time I have reduced the number of cases where the natural teeth have loosened.

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*In this work the phrase "saddle compression" will be used to indicate the appropriate distribution of pressure by the saddle upon the subjacent soft tissues, during the stresses of mastication.

Rebasing Impressions.

I also believe that the practice of rebasing will become universal in a few years. In one of the later chapters I will describe the rebasing of the plate after it is finished, to correct any faults in the technique, but in this chapter I shall confine myself to rebasing the impression, which technique eliminates to a great extent the necessity for the rebasing of the denture.

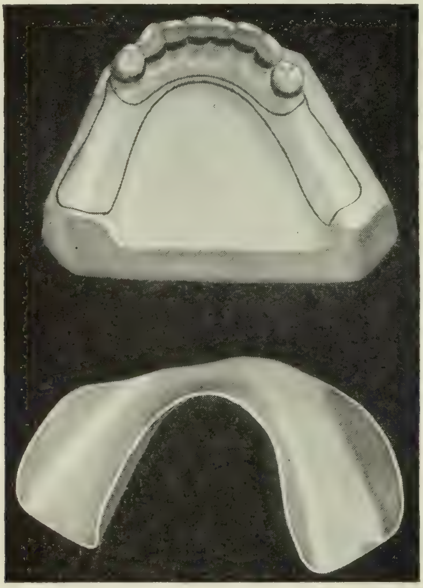


Fig. 49. Class I lower, with tray showing outline and beading. Outline for double bar lower.

There are four methods of obtaining saddle compression. The method devised by Dr. Peeso, which can be used only where we have a gold saddle.

The rebasing of the denture after it is finished, as mentioned above.

The use of medicines such as adrenalin chlorid, to shrink the gum before the impression is taken.

All of these methods have their limitations, and not one allows us to determine before the denture is finally constructed, whether we have succeeded in our efforts.

The fourth, for the sake of clarity, I will call "the rebasing method of taking impressions."

If the student has familiarized himself with the technique of sectional impressions, as described in the foregoing chapter, and has taken a number of these so that he understands the use of compound in its simpler phases, I would advise him to obtain a Class 1, lower, case, and begin his studies of rebasing technique on this type of case, as the Class 1, lower, case, is the one which most often calls for rebasing, is the easiest one to handle, and is the logical one with which to begin.

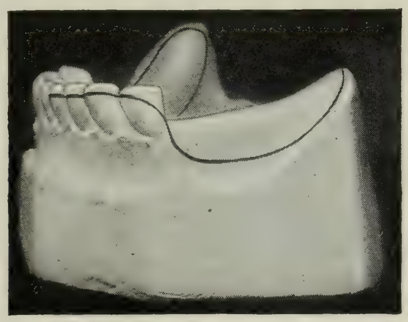


Fig. 50. Class I, showing line where first portion of impression should extend.

The steps in the procedure are as follows: A study model is obtained and outlined, special attention being given to the outlining of the saddles. They should not impinge on the gingiva, nor cover the mylohyoid ridge, and a sharp instrument should be used to engrave a line over the entire plate outline, so that when the modeling compound blank is formed, as described in the last chapter, a beading will show on the blank, and the blank should be cut to a small size, not over 1/8 of an inch larger than the outlines of the saddles. This makes less bulk of blank and more accurate results are obtained. (Fig. 49.)

The blank is cleaned of any small particles of plaster that might have been picked up from the study model, dried and the mouth blow-pipe used with a brush flame, over the internal surface of this blank impression and a pointed flame down in the teeth depressions until the compound is softened for 1/8 of an inch into the body of the blank. It is then dipped into water 145° Fahr., placed in the mouth and pressure exerted on the tray downward and forward towards the front of the chin.

The impression is allowed to harden, or assisted by cold air or water syringe until it attains a density of a pencil rubber. The patient is asked to raise the tongue to the roof of the mouth, and to pass it around the upper teeth and cheeks while the impression is held in place by the fore-fingers, the thumbs supporting the mandible.

If the compound is too soft, it will be necessary to push it against the lingual side of the ridge again with the finger, and the operation must be repeated. If the frenum of the tongue is large, or placed high, it is best to relieve this section after the saddles have been muscle trimmed.

Sometimes it is possible to muscle trim the buccal flange without removing the impression from the mouth, but this is riskful for beginners. This is done by holding the impression down, by placing the first finger on the occlusal surface on one side of the tray, the second finger on the occlusal surface on the other side, with the mandible supported by the thumb, and, grasping the cheek between the thumb and fingers of the other hand, pulling upwards and rolling it towards the ridge. This shortens the impression and compresses it at the same time.

It is much safer for beginners, to make two steps of muscle trimming, and, when the impression has hardened after the tongue movements, the impression is raised 1/16 of an inch from the teeth, raising the back first to release the undercuts, and then it is pushed back and held for fifteen seconds; then it is raised a little higher, then pushed back; again raised, until it releases easily and falls back without a snap. This is the process of reducing undercuts between the teeth, and is the most important point to be observed in modeling compound work.

The impression is dropped into ice water until stone hard, and then reduced along separating lines, running over the occlusal surfaces and incisal edges of the teeth, down to where the saddles begin as shown in Fig. 50. This is done with a sharp knife, and if possible without heating, as heat distorts the impression.

You should be able to drop the impression into the mouth and not need to snap it to place. If a snap should occur, you have not released the undercuts sufficiently, and this will ultimately cause the teeth to loosen due to trauma, the bicuspids being forced apart. This causes greater loss of teeth than that caused by the settling of the plate, unless cast clasps are used, and then damage is done in both directions.

If you are satisfied with the impression at this point, gently heat the buccal flange with the mouth blowpipe, keeping the heat away from the lingual side, place it in hot water and then in the mouth; muscle trim by pulling up on the cheek, as previously described, and chill. Now replace it in the mouth and test to see if the impression rocks when pressure is brought to bear on the saddles.

Test for Need of Rebasing.

Place the left forefinger on the right side of the tray, over the center of the ridge, and press with the right forefinger on the occlusal surface of the tray on the left side of the mouth, starting at a point over the anterior portion of the saddle and working back to the rear of the impression. If no rocking is observed, try the right side, holding the left. The holding pressure should be gentle, and the testing pressure very firm. If no rocking occurs *do not rebase,* as you have sufficient saddle compression. If one side compresses, causing the other side to rise, that side should be rebased, starting at the point where tipping occurs, as it is not necessary to rebase anteriorly of this point.

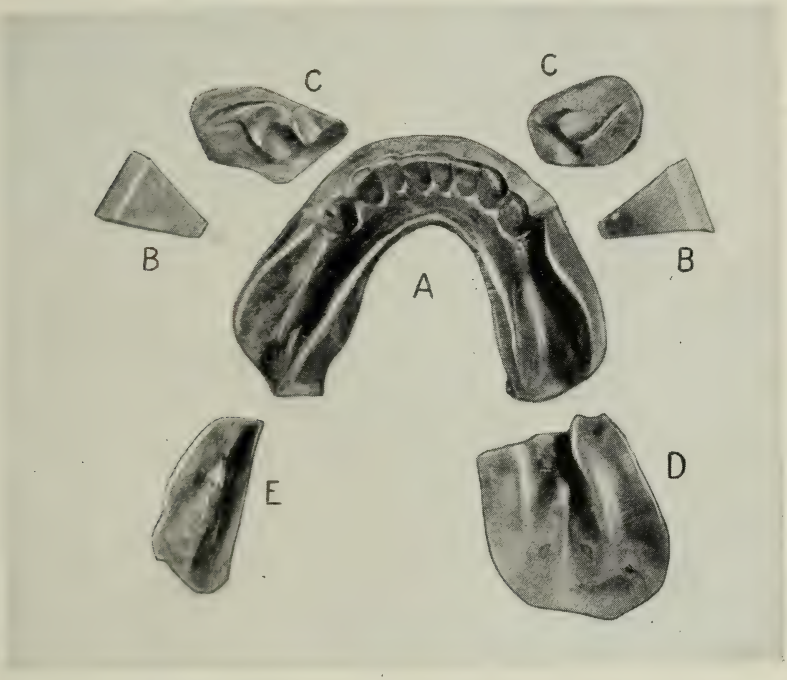


Fig. 51. Parts of impression: A. Impression of the saddle areas trimmed as previously described. B. Cones for impression of buccal surface. C. Buccal surface impression. D. Wafer of compound shaped to fit saddle area. E. Wafer trimmed ready to seal on impression of saddle areas.

Technique for Rebasing Impressions.

The rebasing is accomplished by taking a sheet of compound, a thin sheet, known as a wafer, and heating it over an *alcohol* burner, *not gas,* until it acquires the flexibility of the leather of a glove. Folding it over the finger, place it down in the wet impression and trim with a pair of Ash Universal Scissors, allowing about 1/16 of an inch more than the outline and keeping away from the gingival margin of the anterior teeth by 1/16 of an inch. (Fig. 51.) It is not necessary to rebase the place where the bar is to rest. Outline of rebase area is shown in Fig. 52.

The impression is dried, the wafer placed in position and the edges sealed as shown in Fig. 53. Care is taken not to heat the impression, except at the edge of the wafer. If the impression is held high, the pointed flame of the blow-pipe will not heat the impression and the wafer will melt down and seal itself to the impression. A brush flame is now quickly passed over the surface of the wafer, just enough to heat the wafer through, without heating the impression. After a little practice this can be accomplished with great ease. Then the whole impression is placed in the water heater, for just an instant, replaced in the mouth and brought to position, with even pressure on both sides and holding it with the forefingers on the occlusal surfaces of the tray, with the thumbs under the mandible, until it is hard. Do not attempt to test, or muscle trim, until it is thoroughly hard. Now chill in ice water, place in the mouth and retest.

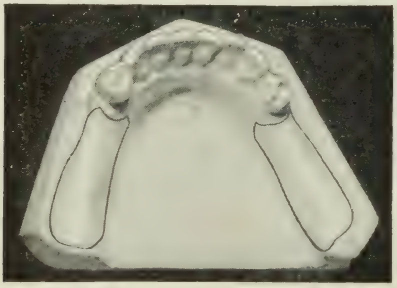


Fig. 52. Outline of portion to be rebased.

It will be found to fit without rocking, if directions have been followed carefully. In most Class I cases, when there is rocking on one side, a little can be found on the opposite, so that it is well to rebase both sides at once. Do not attempt to rebase one side, and then the other, because at each rebasing you will upset the balance of the opposite side.

In rebasing, seal both sides and use the brush flame over both, then place in the mouth with an even downward pressure and in every case see that the impression goes to place; that is, that the teeth are back in their original impression. No space must be left between the impression and the teeth.

With this method, the tissues are compressed evenly with a substance which is as near their own density as any we have and theoretically it is an ideal method; much preferable to plaster or wax.

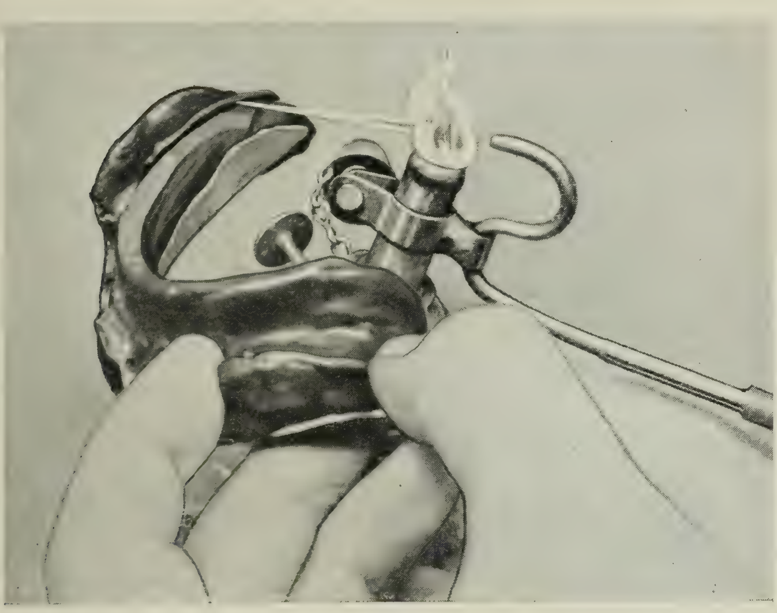


Fig. 53. Sealing wafer for rebasing. Flame held so that the pointed flame is directed away from the opposite flange.

Technique for Completing the Impression.

The impression is now finished in two steps, first that of obtaining the buccal surfaces of the teeth to be clasped, and the repairing of any imperfections with carding wax.

The buccal sides of the bicuspids or cuspids to be clasped, are taken, so that the material can be drawn off at right angles to the long axis of the tooth, and in cutting the first portion of the impression, care should be exercised to permit this. Do not cut the compound at an acute angle as in Fig. 54 at A, but at an obtuse angle as in Fig. 54 at B. A small cone of compound is heated. Cones need not be purchased, but can be made by forming them of scraps left from the impression, and setting them on the glass working surface of the bench, until the base hardens. They are then pushed against the buccal surface of the teeth to be clasped, after the first portion of the impression has been replaced, and its surface wet to prevent the new compound from adhering. Also do not forget to dip the hot portion of the cone in water, before placing in the mouth, or you may burn the patient.

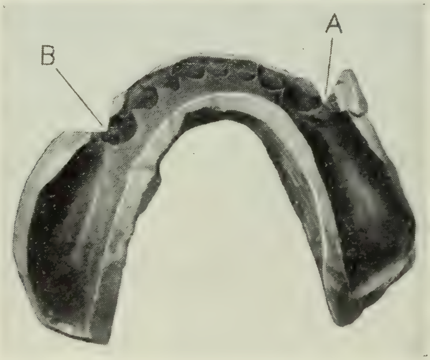


Fig. 54. Cut the compound, not at an acute angle as at A, but as at B, at right angle to the axis of the tooth.

Correction of Imperfections.

If any imperfection is noted, on the surface of the compound, and this sometimes occurs at the line just where the wafer used in rebasing is attached, a small quantity of carding wax is melted into the imperfection, (Fig. 55) smoothed with the mouth blowpipe, and the impression is placed in the mouth and considerable pressure brought to bear. When it is taken from the mouth, any surplus beyond the imperfection is removed and the impression is complete. If the imperfection should be on the gingival margin, care should be exercised to remove any surplus wax which may have been forced down into the impression of the teeth. This is easily done if when applying the carding wax, the impressions of the teeth are not dried. Only that portion of the impression is dried which is imperfect, and this is done to allow the carding wax to adhere to it.

If too much wax is used, it spreads over the perfect portion of the impression, but is easily lifted off with some smooth instrument which will not mar the surface. If in testing for tipping, we find that the impression does not tip until we reach the extreme back portion of the tray, it would mean that not more than the last quarter of the saddle needs rebasing, in which case it is much easier and safer to rebase a small portion with carding wax, than to risk the rebasing with compound. The three portions of the impressions are fastened together with wax, boxed, and poured in the usual manner.

Technique for Class I, Upper.

The next easiest to handle is a Class I, upper case, and it is seldom necessary to rebase this type. Great attention should be paid to plate design. If we are planning to design a plate which will cover the entire palatal portion of the mouth, it is seldom necessary to rebase with wafers. The majority of the impressions of this type, will not rock if the modelling compound blank is made on the study model, heated with the mouth blowpipe, and forced into place by placing the finger on the center of the tray, pressure being exerted in the direction of the bridge of the nose; that is, to say upward and forward.

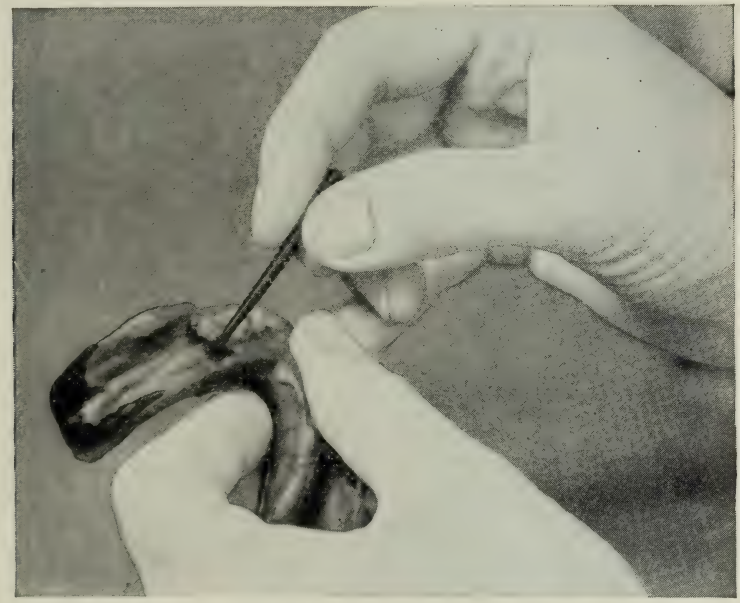


Fig. 55. Imperfections covered with carding wax.

After the impression has been chilled with cold air or water, to the consistency of a rubber on the end of a lead pencil, it is lifted down a short distance from the edges of the teeth and then forced back into place again, as described in technique for a lower case, and finally released. As with the lower impression, when you have become expert, the muscle trimming can be done just before the impression is released, but for the beginner I would advise that the muscle trimming be done as a separate step. This is accomplished by heating the buccal flanges with a mouth blowpipe, dipping the impression in water to equalize the heat, and placing it in the mouth. While it is held with one hand, the other hand is used to pull the cheeks downward and press inward at the same time. This prevents the compound from being dragged away from the ridge.

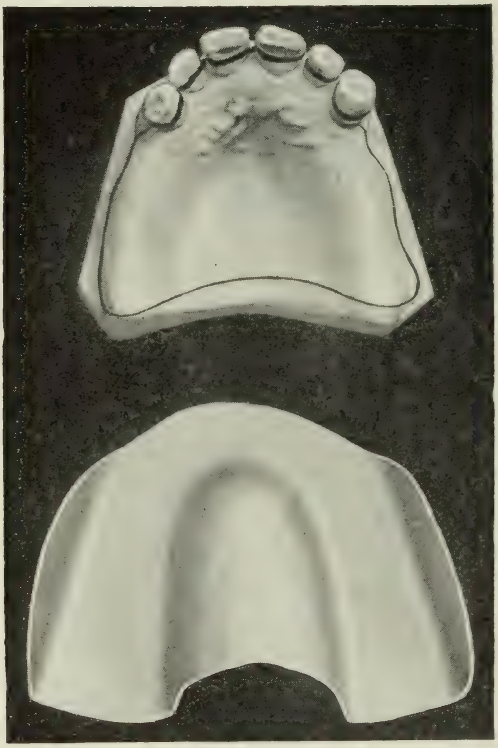


Fig. 56. Class I, upper, with tray cut and case outlined.

Technique for Post-damming.

The next step will be that of post-damming. The impression is heated on the back edge, dipped in the water and placed in the mouth with a firm upward pressure. The patient is instructed to close and open the jaws, and then to swallow. The finger must be held in the mouth while he swallows, or the impression will be displaced. The impression is chilled, and lifted from the mouth, and, if it is noted that the impression turns down on the back very sharply, a sharp knife should be used to trim any surplus that extends beyond this down turn.

If more pressure is desired on the rear edge, which nearly always is the case, the area to be post-dammed can be covered with carding wax melted on the impression by heatng one of the pencils of carding wax, and spreading it over the desired surface.

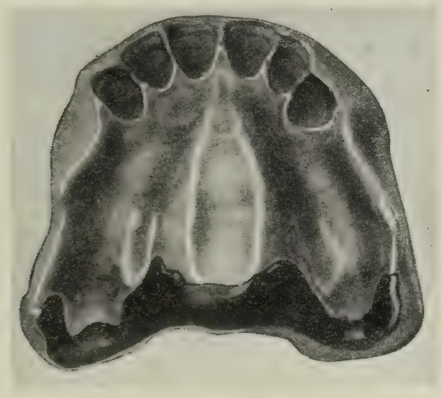


Fig. 57. Impression post-dammed and area to be scraped indicated in white.

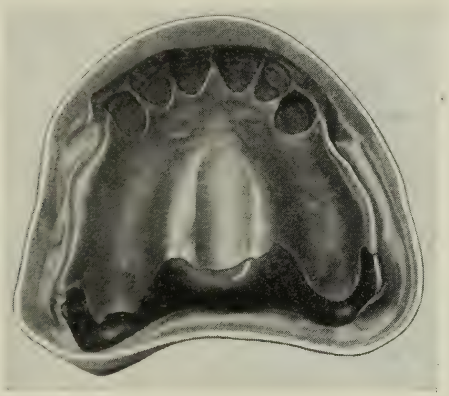


Fig. 58. Impression boxed. Boxing wax not in contact with the edge of the impression but held away by a small roll of wax.

"Post-damming" is a technical term used by modeling compound workers to mean the building up of the impression to obtain extra compression over that area where the hard palate joins the soft palate. This area is compressible, but does not move when the soft palate moves. It is this area which we try to cover with carding wax, and it should be studied out when our first impression is taken, and marked on the study model. The best way to determine it, is to use the forefinger, carefully passing it back in the mouth to avoid gagging the patient.

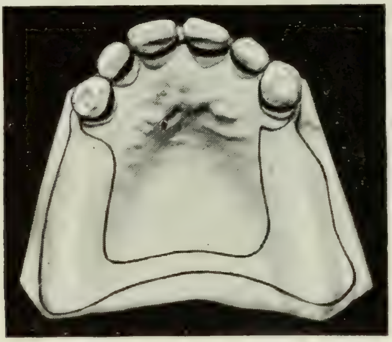


Fig. 59. Class I, upper. When labial and palatal bars are used, this design serves nicely, when marked hard spots are in the center of palate.

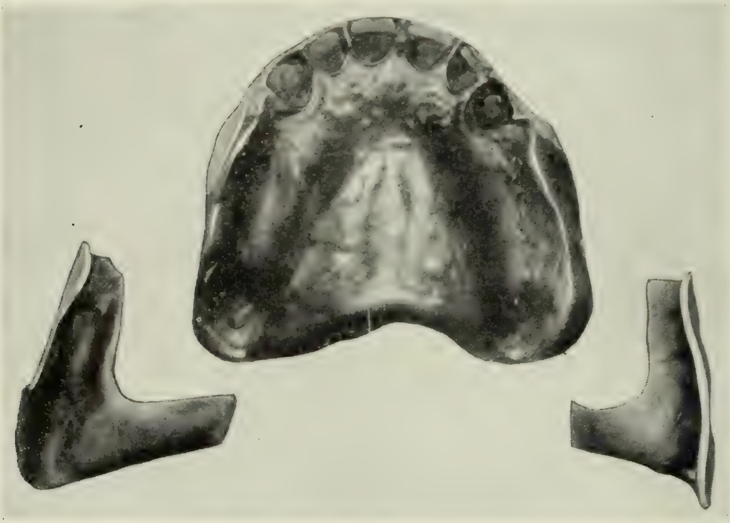


Fig. 60. Impression of Class I, upper, with rebasing wafer cut, ready to seal in place.

After the carding wax has been traced on the impression, over the proper area, it is heated with the mouth blowpipe to make it smooth and the impression is forced to place. Any surplus will crawl out at the back edge of the impression and can be removed if necessary.

It is advisable in this type of work to relieve hard areas and this can be done after the model is obtained, or by scraping the impression. (Fig. 57.) It is also advisable to relieve the areas over the posterior palatine canals. These can be located by taking an egg shaped burnisher and pressing where the alveolar ridge turns from the palate, and about one-quarter of an inch anterior to the juncture of the hard and soft palates. They can be marked with an indelible pencil, and when the impression is placed in the mouth, if it is wet, the mark will be transferred to the impression. These areas are scraped, the same as the hardened areas. It is claimed that this scraping helps to prevent absorption by stopping the strangulation of the vessels which come out at this point. It is best to scrape the impression before the post-damming is done with the carding wax, as it would be almost impossible to scrape the area without destroying the post-damming.

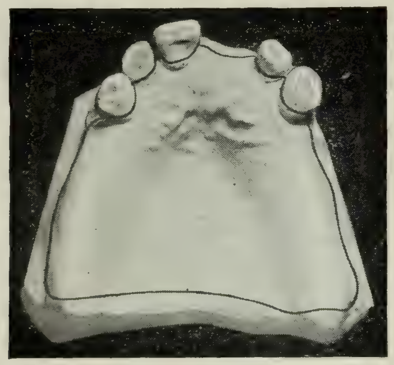


Fig. 61. Class I, modification I, upper.

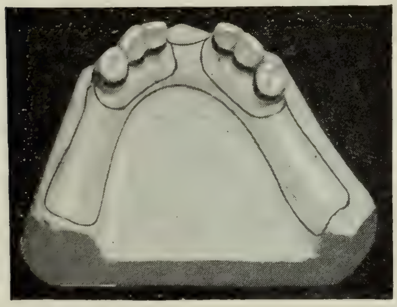


Fig. 62. Class I, modification I, lower, outlined for double bar.

The impressions of the buccal surfaces of the upper teeth required for clasping are obtained in the same manner as that described for the lower impression, and the three pieces are assembled, waxed together, and the impression boxed.

In boxing the upper impression care must be taken not to destroy the post-damming. Hence a little extension of the boxing wax must be applied in such a manner that when the outer wall of the boxing wax is in place it does not touch the carding wax. (See Fig. 58.)

If it is decided to make for the patient a plate which does not completely cover the palate, simply two saddles connected by an anterior bar which rests on the teeth, and a posterior bar which crosses the palate at the junction of the soft and hard palate, then it will be necessary to rebase that portion of the impression which is covered by the posterior bar and the saddles.

This type of denture adapts itself nicely, where there is a marked hard spot in the center of the palate, or, where there is sufficient curvature of the anterior teeth as they are set in the arch to convert the anterior bar into an indirect retainer. There are definite rules which allow us to determine whether this type of plate will be satisfactory or not.

If it is decided to make a plate of the horse-shoe type, we must get some compression at the point where the plate ends on the palate. This is done by applying black carding wax on the impression over the plate line and placing it into the mouth to compress the tissue, or by scraping the model slightly on this line.

Impressions for Upper Bar Cases.

It will be necessary at this time to describe the taking of the impression for this type of saddles.

The study model is carefully made and outlined, and attention should be paid to the part of the saddle which is immediately distal to the last tooth. (Fig. 59.) The saddle should never impinge on the gingiva, and the bar if possible should never cross the palate where there is a hard spot. In cutting the wafer, one saddle and one half of the posterior bar is included, and then the other saddle and the other half of the posterior bar. (Fig. 60.)

The impression is dried and the first wafer is sealed at its edges by means of a pointed flame from the mouth blowpipe. The other half is similarly sealed and a brush flame is passed over it, the entire wafered surface is dipped into hot water to equalize the temperature, and then placed in the mouth, pressure being exerted over the center of the palate with one finger, with force directed toward the bridge of the nose. The impression is thoroughly chilled and lifted from the mouth, and if there are any slight imperfections these are filled with carding wax and the procedure as described for other impressions is followed. If an imperfection occurs in the impression at some point which is not covered by the plate, it would be folly to attempt to make a careful patching, as that would be a waste of time.

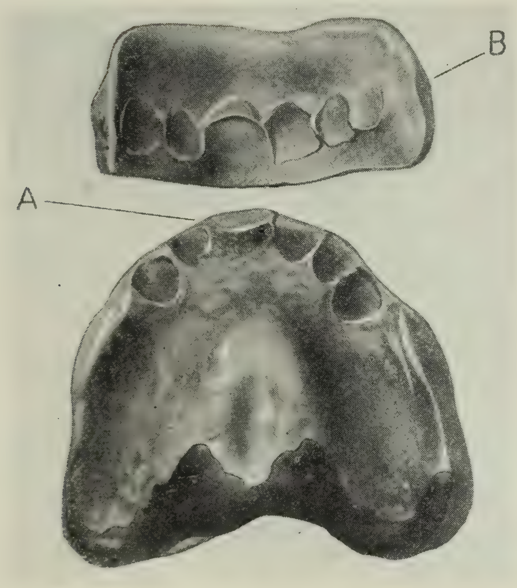


Fig. 63. Impression of Class I, modification I, upper. A. Space between central and lateral incisors trimmed to the top of the ridge. B. Labial impression taken in one section.

I have seen men spend from ten to fifteen minutes trying to fill in an air bubble in an impression, which was far removed from the plate outline, and in doing so lose the fit of the impression. I do not wish the student to misconstrue this statement as encouraging sloppy work, but I have had men point out slight distortions in teeth, which were far removed from the plate, and use it as an argument to condemn modeling compound impression work, whereas in taking plaster impressions, these same men would lose small portions of the impressions at points which are vitally important, such as lug seats, and portions of the teeth to be clasped, filling these in with wax and guessing at their shapes, or else waiting until the cast was made and trimming it down.

Modifications of Class I, upper, (Fig. 61), and lower, (Fig. 62), type of cases are taken in the same manner as Class I, except that instead of just taking the teeth to be clasped, we must obtain an impression of the teeth on each side of the space and that portion of the ridge in the space which is to be covered by saddles. In trimming the first portion of the impression, if there is one anterior space, or a number of them, we trim the impression in the same manner as in the Class I type, but we trim away any surplus compound which extends beyond the midline of the ridge, or around the adjoining teeth, as shown in Fig. 63 at A.

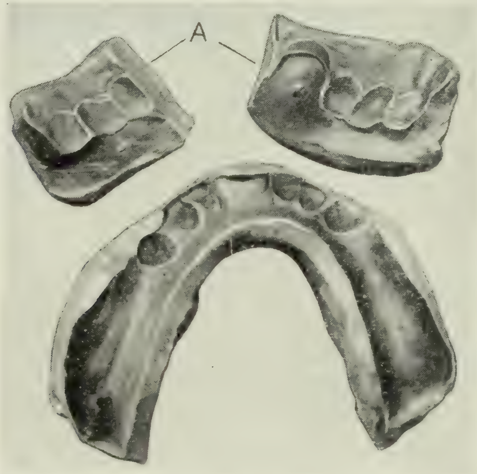


Fig. 64. Impression of Class I, modification I, lower. A. When bicuspids are present, the labial section is taken in two sections. Dividing line on a tooth and not at the space.

The first portion of the impression is completed in the same manner in which we completed the first portion of the Class I case, and a piece of No. 7 metal is cut to cover the entire labial portion of the teeth; one side is covered with modeling compound as described in the last chapter, and forced to place. (Fig. 63 B.)

If the case is of such a type that there are no teeth extending beyond the cuspids, the impression can be taken in one piece, but if the bicuspids are present, it will generally be necessary to divide this up into two pieces. Have the dividing line come at the center of one of the teeth, not at an edentulous space. (Fig. 64.) If when placing a section back on the first

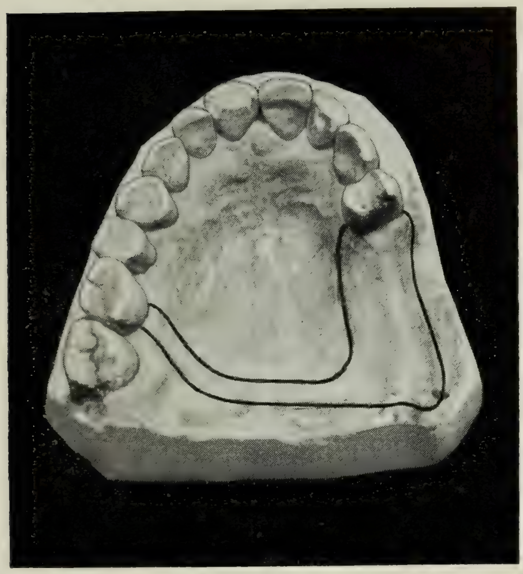


Fig. 65. Cast of Class II, upper, with denture outlined.

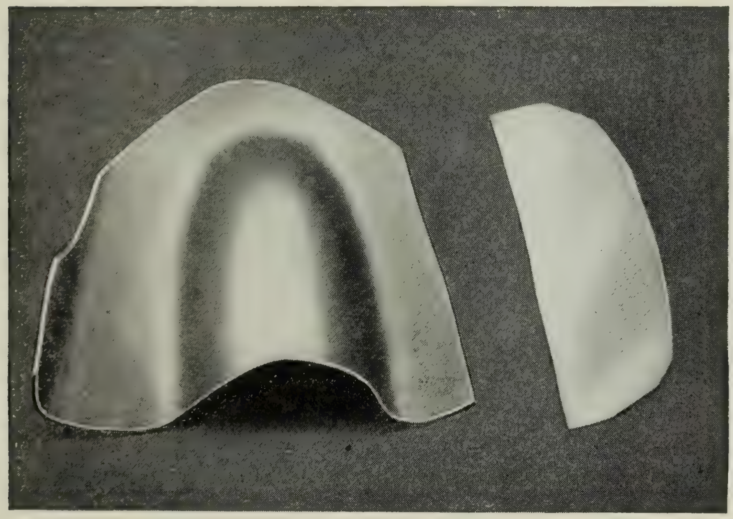


Fig. 66. Tray cut for Class II, upper.

portion of the impression, we find that the line on the top of the ridge does not come together closely, it is best not to attempt to correct this by adding compound, but rather to correct it by adding carding wax. These impressions are assembled, boxed and poured.

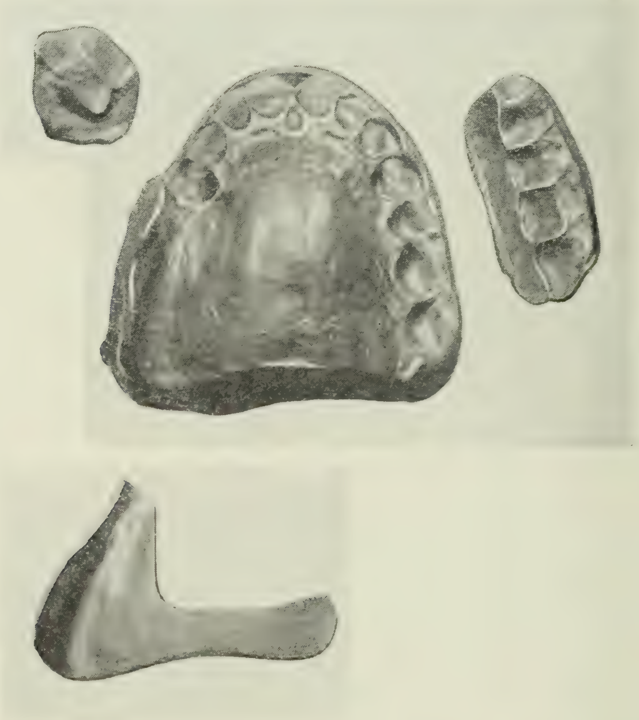


Fig. 67. Parts of the impression of a Class II, upper, showing rebasing wafer cut ready to attach to impression. Also note beading on the outline of the saddle and bar areas.

Impression for Class II, Upper.

A Class II case, is that type of case where the saddle is unilateral and has no posterior support.

This case presents no unusual difficulties in impression taking, but as the success of these dentures depends greatly on the design, the outline should be carefully marked on the study model and a sharp instrument used to engrave, or indent this outline. (Fig. 65.) The impression tray is cut so that it will cover the occlusal and lingual surfaces of the teeth, as well as the entire palate. This tray (Fig. 66) is filled with compound in a similar manner as the Class I case illustrated in Fig. 30, and the compound is heated to the proper degree and pressed upon the wet study model to form an impression blank. It is lifted from the model and trimmed to 1/8 of an inch outside the outline. If the outline has been indented, as mentioned above, it will appear as a beading on the impression blank, giving us a guide to trim by. Any small pieces of plaster, adhering to the compound, are removed, and the surface of the impression is heated with the mouth blow-pipe, dipped into hot water and placed in the mouth with an upward and forward pressure in the center of the tray. When sufficiently hardened to begin muscle trimming, the impression is held by the thumb and forefinger of one hand, the other hand grasping the cheek, pulling downward and at the same time pressing toward the ridge, to prevent pulling the compound away from the ridge. The impression is then lifted about 1/16 of an inch from the tissue. This is repeated two or three times, increasing the distance each time until the impression is easily removed.

If the impression is released from the saddle side first, (as shown in Fig. 42,) we can obtain a more accurate impression of the curvature of the lingual surfaces of the remaining teeth. It is then chilled in ice water, and trimmed with a sharp knife at the posterior edge, and at the incisal and buccal-occlusal edges of the teeth. Care should be taken in trimming the impression on the buccal, or labial, surface of the tooth which immediately joins the saddle area, so as not to allow any of the undercut to remain in this portion of the impression, (Fig. 67), as it is bound to drag and an accurate pattern for the clasp could not be made on the resulting tooth. Likewise, the impression should be cut at this point, at right angles to the buccal or labial surface of the tooth, so that when the buccal or labial impression is taken, it will release without dragging.

This, the first portion of the impression is placed back in the mouth for testing. The same procedure is followed as in Class I cases as previously described under the sub-heading, "Test for Need of Rebasing." If the impression shows a tendency to rock, it must be corrected at this time, and it is here that we make a slight difference in overcoming the rocking, depending on the design of the denture.

If the denture is to be of the horse-shoe type, or that type which covers the entire palate, the impression is lightly reheated with the mouth blowpipe, endeavoring to reheat the impression of the teeth, slightly more than the impression of the saddle area.

This method has proven more satisfactory in my hands when these types of dentures are to be constructed than in endeavoring to use the

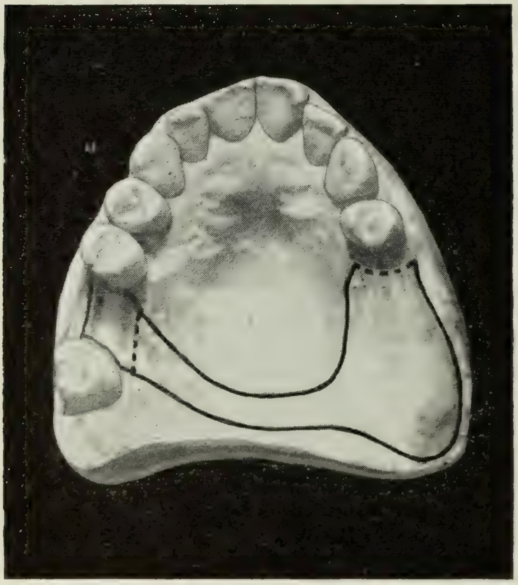


Fig. 68. Cast of Class II, modification I, upper. Note that the outline for the rebasing wafer does not come to the bicuspid, nor between the bicuspid and molar on the opposite side, where the denture is to extend, but should stop at the dotted line.

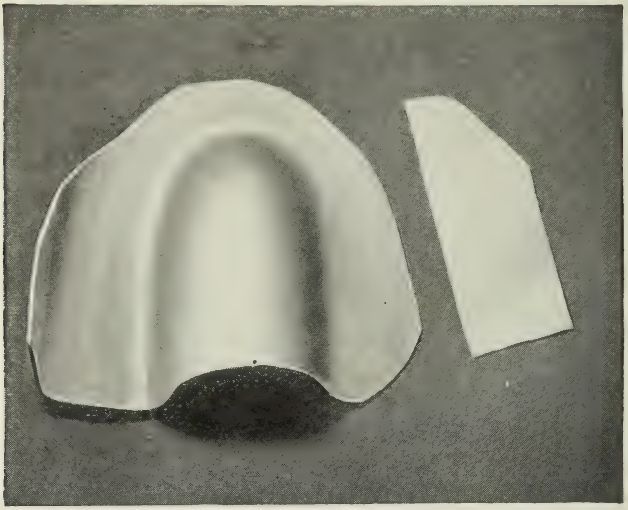


Fig. 69. Tray cut for Class II, modification I, upper, with pewter side piece.

rebasing method. The rebasing method was developed by me to take care of the saddle and bar type of dentures.

When the design calls for a saddle and palatal bar, we heat a wafer of compound over an alcohol burner, pushing it into the wet impression with our fingers, care being taken not to allow it to develop folds, and then trimming this wafer to extend 1/8 inch beyond the beading, which is produced by the outline on the study model. The compound wafer, when it is trimmed properly, should cover the entire saddle area and that portion of the palate which is to be covered by the bar, and should be 1/8 inch larger than the outline of these portions, so as to allow for shrinkage when it is sealed to the impression with the mouth blowpipe. It should not come closer to the gingival margin of the teeth than 1/8 of an inch.

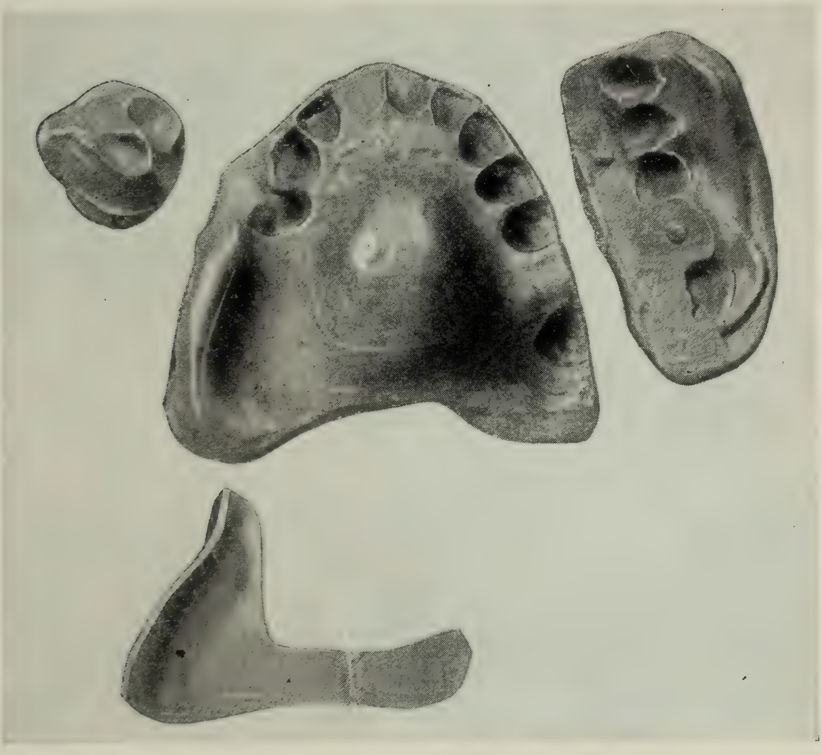


Fig. 70. Parts of impression on Class II, modification I, upper.

After sealing, the compound is dipped into hot water and replaced in the mouth, and as much pressure brought to bear upon it as can be comfortably borne by the patient. This will compress the tissues over the saddle and bar areas of the denture, and will prevent rocking.

I believe it is of the utmost importance to prevent pressure on the gingival margin of the gum, and the longer I practice dentistry the greater necessity I see for the type of denture construction which prevents pressure in this region. In every illustration shown here, where the old fashioned type of plate denture was used, and the patient showed signs of gingival irritation and had a history of loss of teeth, the gingival irritation disappeared after the double bar type of denture was used. The two cases shown, Fig. 71 and Fig. 74, came to me with a great deal of gingival irritation and a history of loss of teeth ascribed to improperly fitting dentures. One of these, Class II, modification I, (Fig. 74), has been worn for six years without further loss of teeth, and the other (Fig. 71) has been worn for five years, which I think is recommendation enough for the double bar type of denture.

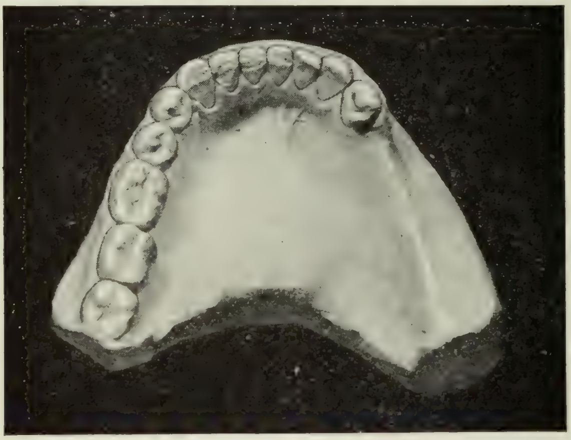


Fig. 71. Cast of Class II, lower.

Impression for Class II. Modification I.

Class II, modification I, upper, include cases which have a saddle on one side of the mouth, unsupported posteriorly, and on the opposite side a saddle with posterior support. (Fig. 68.) They are handled in a similar manner to a Class II case. We cut our tray to cover the palatal vault and the area of the saddle which has no posterior support, terminating at the incisal edge of the anterior teeth, and the buccal-occlusal edge of the posterior teeth. (Fig. 69.) The compound blank is made on the study model, and trimmed with a sharp knife, as in Class II cases, except that we trim the saddle which is supported at both ends, to the top of the ridge, or just slightly over the crest of the ridge, on the buccal side. The impression of the buccal surface of this ridge and the teeth adjoining, which are to be clasped, (Fig. 70) is taken with a piece of softened modeling compound, backed up with a piece of pewter tray metal. It is a good idea to make little key marks on the flat cut surface of the first part of the impression, at this point, so that when this buccal impression is fitted back to place, the key marks will make it seat properly. These key marks are shown in Fig. 43, and can be made by taking the point of the knife and rotating it on the flat surface of the compound.

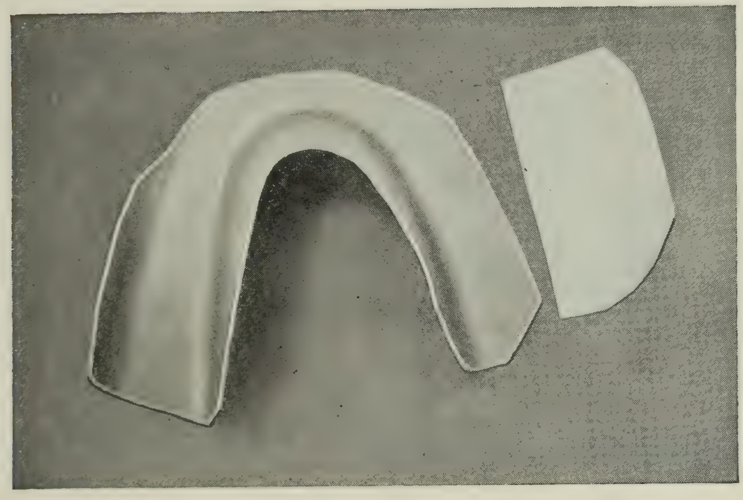


Fig. 72. Tray cut for Class II, lower.

The first part of the impression is tested for tipping, and if any tipping occurs, it is corrected in the same manner as in correcting Class II cases. If we rebase with a wafer of compound, it should not run on the impression of the ridge between the teeth, if that space is less than three teeth in width, (See Fig 68—dotted line), because the softened compound in such narrow areas catches, and drags down into the occlusal surface of the teeth, preventing us from properly reseating the impression. As the stress of mastication is resisted by the occlusal lugs, it is not necessary to have saddle compression, where teeth are on each side of a saddle space.

To obtain a smooth impression at this point, the carding wax is used to fill in any little imperfections. This wax has the advantage of being easily removed, if too much is used and any of it gets on the occlusal surfaces of the teeth. Carding wax never should be applied to an impression, until all the sections of the impression have been taken. It should be the last thing done before assembling the impression.

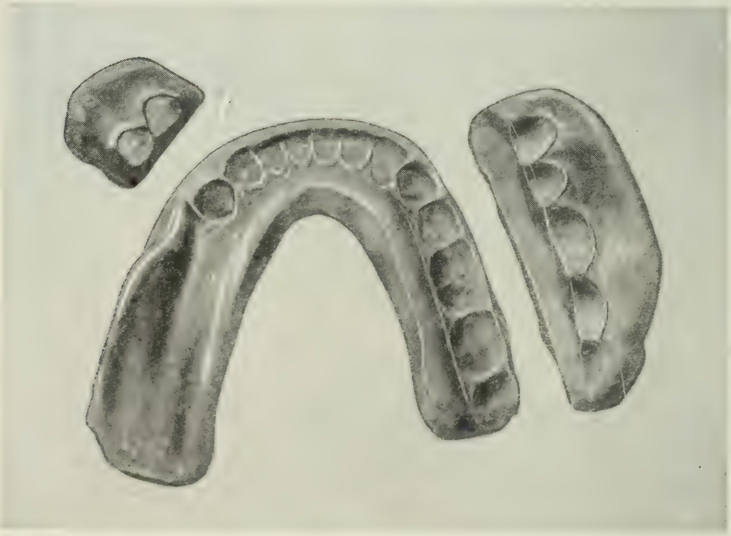


Fig. 73. Parts of impression of Class II, lower.

Cause and Prevention of Gagging.

As in a Class I case, if the design of the denture is of the horse-shoe type, or covering the entire palate, I trace a little of the carding wax along the posterior edge of the denture outline, in order to obtain a little extra compression at this edge and to prevent the ingress of food. This, if neglected in the impression, can be done by scraping the cast, and certainly it adds to the comfort of the patient and, I believe, to a great extent, prevents gagging.

The Class II case, upper, (Fig. 67) was a chronic "gagger," and an attempt had been made by two very excellent general practioners, to make a horse-shoe shaped denture, without success. Both of these men referred the patient to me, and by compressing the tissues at the posterior edge, by the method described above, the patient wore the denture without further gagging.

The cause for gagging, is not the length of the denture, but rather the fact that most gaggers have a ropy saliva, which collects under the loose, posterior edge of the denture. As the patient breathes, this saliva is drawn backwards against the soft palate and acts exactly as a feather would; tickling, and causing gagging. Gagging can be prevented by holding the denture tight in place, or giving an extra post-damming. This is proven by the fact that if the patient is gagging, and you tell him to bite, and breathe hard through the nose, the soft palate is forced tight against the rear edge of the denture and gagging nearly always ceases. The point I want to bring out is that the patient will very often gag, with a horseshoe shaped denture which does not fit tightly at the posterior border but will not gag with a bar denture, or a full denture, which fits tightly at the posterior border. If this fact is recognized, a change of design in bar dentures will be made, and the bar will cross the palate at a place on a line drawn between the second and third molars, at the juncture of the hard and soft palates, where the tissue is compressible, but not movable. Bars that are so designed, do not interfere with the tip of the tongue, and do not prevent correct articulation of speech; do not cross hard spots in the palate, are much better tolerated by the patient, and have a tendency to stabilize the denture.

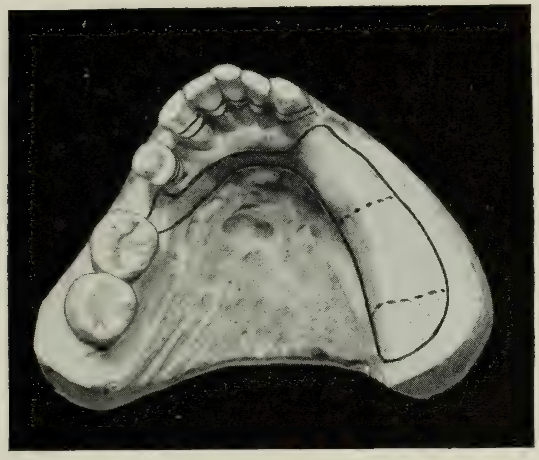


Fig. 74. Cast of Class II, modification I, lower.

Class II Modifications.

Class II, modification II; Class II, modification III; Class II, modification IV; are handled in exactly the same manner, taking the impression, as for Class II, modification I. If there are openings between the posterior teeth, and also between the anterior teeth, it is advisable to split up the buccal and labial impressions, into as many parts as may be necessary to enable us to draw these off at right angles to the buccal or labial surfaces of the teeth. The dividing line is generally made in the middle of the cuspid, or first bicuspid tooth, and it is seldom necessary, in these cases to have more than two pieces on the buccal and labial sides.

Impression for Class II, Lower.

In Class II, lower, (Fig. 71) the tray is cut to include the saddle area, the lingual surfaces of the anterior teeth, and the lingual and occlusal surfaces of the posterior teeth (Fig. 72). The procedure in forming the compound blank and taking the impression is the same as in the upper case.

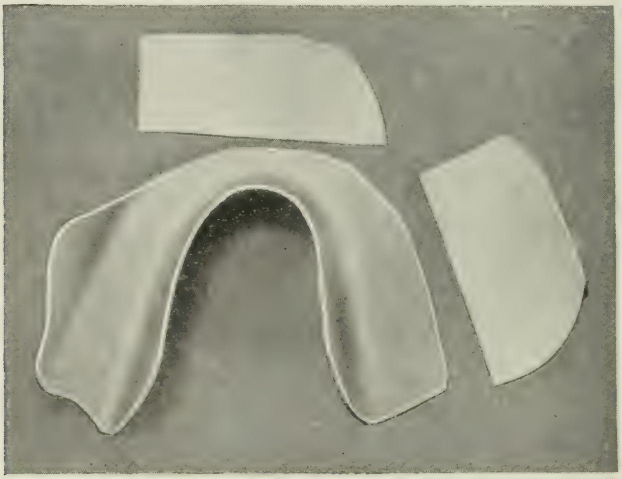


Fig. 75. Tray cut for Class II, modification I, lower.

In this type of impression, the saddles are always rebased by means of wafers of compound, and a careful study should be made of the ridges to determine the compressibility (Fig. 73). I have, in many instances, found that in long saddles as illustrated in Fig. 74, there are sometimes three degrees of compressibility, the ridge growing softer towards the rear.

In Class II, modification I, lower, as illustrated in Fig. 74, the first rebasing was not sufficient to prevent tipping of the denture. A second rebasing was necessary, covering fully 2/3 of the distal portion of the ridge, and a third rebasing was done covering the distal third of the ridge. Fig. 76 shows the wafers of compound used.

As I had tried this case before with a plaster impression, and it could not be retained on account of tipping of the denture, I tried it with a compound impression, and a plaster wash, with the same result. At last, a perfect rigidly fitting denture, was made by using the rebasing technique above described. It was this case, (which I have mentioned before as having been retained six years without further loss of teeth), which led me to discard the older methods of taking impressions, and after testing it in hundreds of other cases, and comparing results with other men, I am convinced that this method of compressing tissues solves one of the great difficulties in partial denture construction.

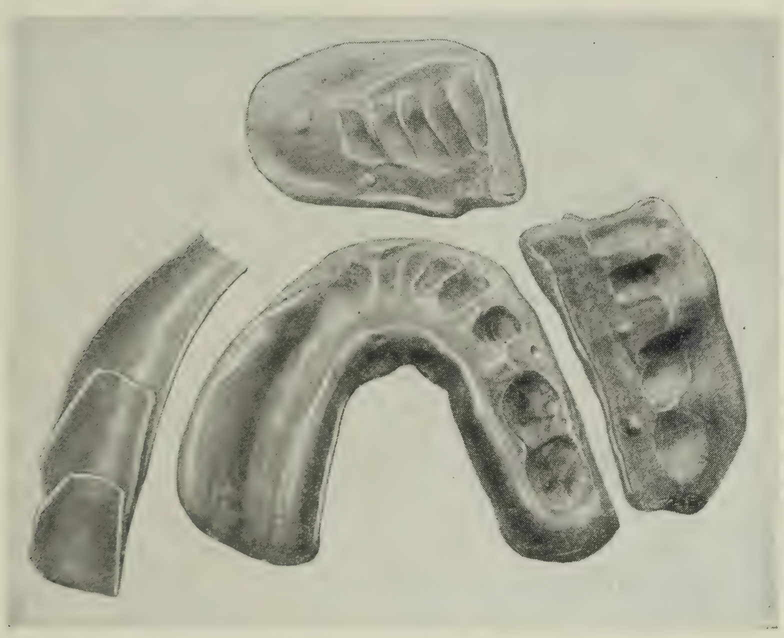


Fig. 76. Parts of impression of Class II, modification I, lower. Note the rebasing wafers.

The Class II, lower case, (Fig. 71) had a similar history in the hands of another man, and the denture made for him has proven very successful by taking the impression in the manner described.

In these Class II, lower cases, where some other form of attachment than the clasp is being used, it will be necessary to have the attachment constructed and placed in the mouth before the impression is taken. This holds true also of the Jackson crib type of clasp, if the teeth in the lower have a great lingual inclination.

Crib Construction.

The crib should be constructed by taking a small sectional impression of the tooth to be clasped. The crib clasp should then be made, placed in the mouth, held firmly in position by tightening the crib wires, and the impression taken around it. It should be borne in mind that this is not necessary unless there is a great lingual inclination of the teeth to be clasped. Also, it is not necessary to take the impression of the buccal surface, if the crib has been constructed first on a separate cast.

Impression for Class II, Modification I, Lower.

In Class II, modification I, lower, (Fig. 74), or in any of the other modifications, the procedure of taking the buccal and labial surfaces is the same as in the upper. The form of tray is illustrated in Fig. 75. Care should be taken to divide these sections in as many pieces as will be necessary to allow us to draw them off at right angles with the labial or buccal surfaces of the teeth, (Fig. 76).

Impressions for Class III, Upper.

A Class III, upper, case is that type of case where we have a unilateral saddle with anterior and posterior support.

These cases, where the space is short, with one or two teeth missing, can be handled by removable bridgework, or fixed bridgework attached to inlays, or with the Nesbett or Bonwill type of construction.

If it is the intention of the dentist to use the Nesbett technique, he recommends plaster impressions, and packs amalgam into the impression to form those teeth on which the patterns for the cast clasps are to be made. I would advise the student who intends to make Nesbett bridges with cast clasps, to follow closely the technique as described by Dr. Nesbett, because in this way he will obtain much better results. However, if a Bonwill type of construction is to be used, the modelling compound impression gives a better result than the plaster. The Bonwill type of construction differs from the Nesbett, in that the Nesbett depends entirely upon the clasps to support the bridge, while the Bonwill type depends partly upon the saddle, and it is due to this fact, that many of the bridges supposed to be of the Nesbett type have failed, because of neglect to follow Nesbett's technique and omit the saddles.

In the Bonwill type of construction we do not use the cast clasp, but rather the wrought clasp, and there is enough spring in the wrought metal to allow it to overcome any movement in the denture which is caused by the compression of the gum under the saddles. Hence the modeling compound impression is an aid in the Bonwill type of bridge construction, as it allows us automatically to relieve the undercuts between the abutment teeth, thus eliminating any filing of the bridge when we come to place it in the mouth; and as wrought metal is thin, it would be disastrous if any

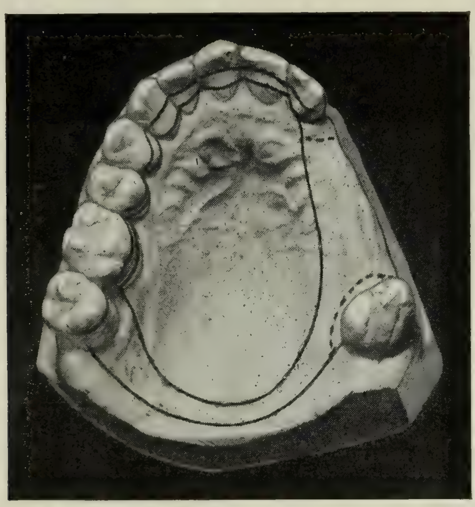


Fig. 77. Cast of Class III, upper.

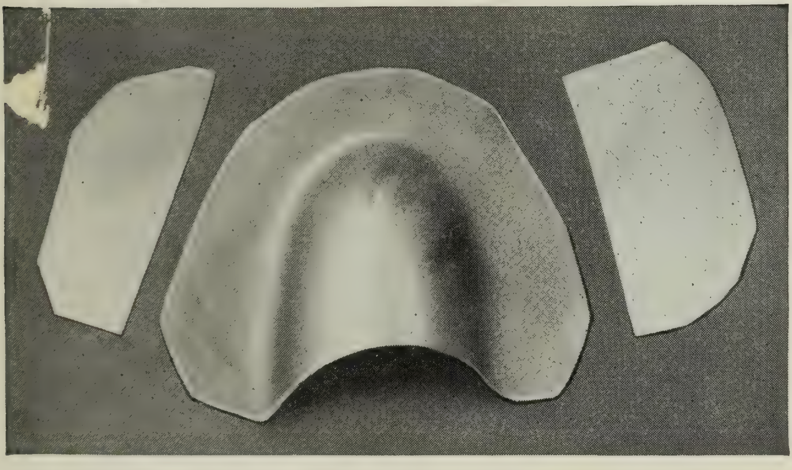


Fig. 78. Tray cut for Class III, upper.

amount of filing had to be done as we would more than likely ruin the clasp, while in the Nesbett type of construction a certain amount of grinding can be done as the cast clasp is much thicker.

Impression for Bonwill Bridge.

In taking an impression for a Bonwill bridge, I cut a piece of the pewter tray metal to include the lingual and occlusal surfaces of the teeth and the saddle area on the lingual side and apply a piece of softened compound, then take the impression of the surfaces above mentioned. The separating line is then trimmed with a sharp knife so as to run over the buccal-occlusal edge of the teeth and across the saddle area about 1 mm. below the top of the ridge on the buccal side. Key marks are made by rotating the knife point on the flat surface which is left when the compound is cut, and then a piece of tray metal is cut to cover the buccal side of the teeth and the ridge on the buccal side. This is covered with a warm piece of compound, and the first section of the impression is put into place and held very firmly while the second section is taken. If the operator feels that it is necessary to obtain saddle compression, he should not attempt to rebase these saddle areas with compound, but should use a thin coating of carding wax, as described in the technique for patching, in Class II, modification I. The impression is boxed and poured.

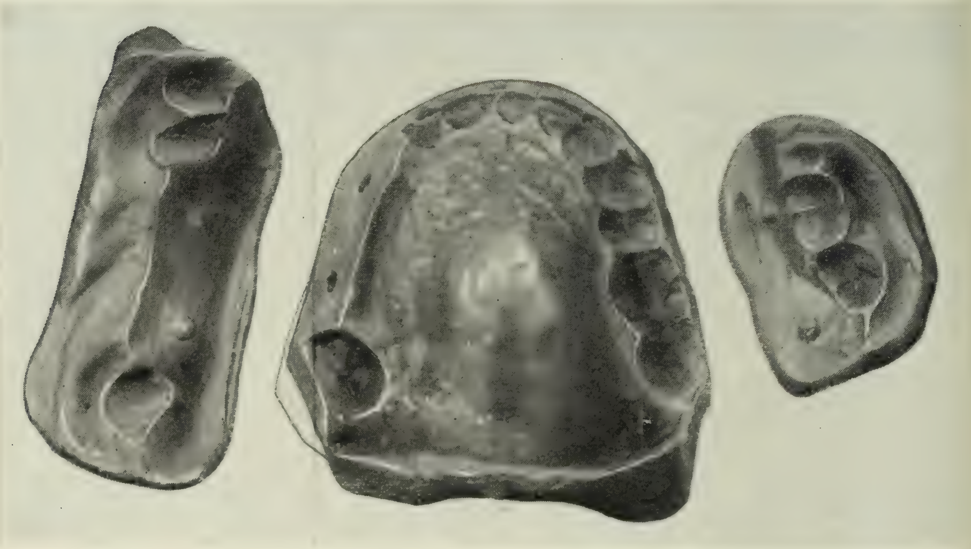


Fig. 79. Parts of impression of Class III, upper. Note the key marks where the buccal piece fits to the first portion of the impression.

If the space to be supplied with teeth is long and the abutments are weak (Fig. 77), it will be best to cross the mouth with a bar to prevent lateral strain. The impression is taken by cutting the tray to include the occlusal and palatal surfaces. (Fig. 78.) A piece of compound is placed upon a tray and forced into place on the study model. Care should be taken that the tray is not forced up far enough to allow any of the teeth to touch it, as this will always produce rocking. The compound is chilled by a blast of air, lifted out of the mouth and trimmed with a sharp knife. (Fig. 79.) The impression should include the occlusal and lingual surfaces of the remaining teeth and should terminate at the posterior edge about 1/8 of an inch beyond the denture outline. It should be cut at the top of

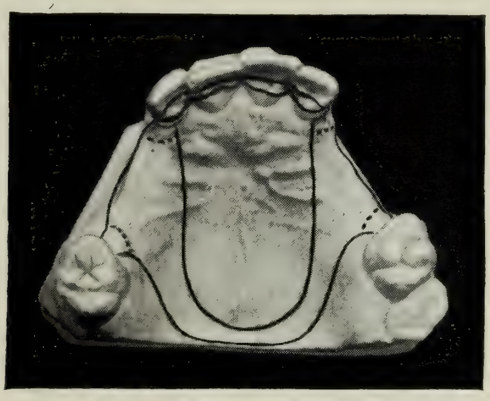


Fig. 80. Cast of Class III, modification I, upper.

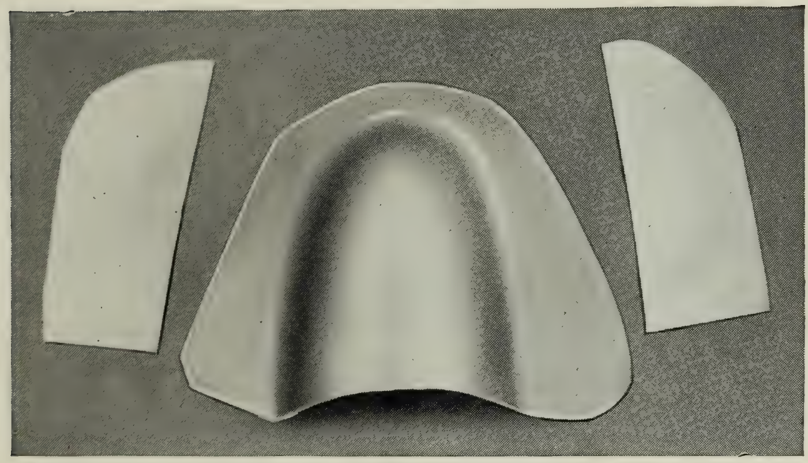


Fig. 81. Tray cut for impression of Class III, modification I, upper.

the ridge, or a little to the buccal side, if the ridge is flat. If the ridge is sharp, it should not extend on the buccal side beyond 1 mm. from the center of the ridge.

If the impression rocks on testing, it will be necessary to reheat the impression with the aid of a mouth blowpipe and to force it back into place in the mouth. The buccal sides are taken in the same manner as other buccal areas by applying compound to the pewter tray metal and pressing it into place. If the bar covers an extensive area, and some tipping occurs when testing, good results may be obtained by applying a thin layer of carding wax to the bar outline, as in Fig. 82, and forcing the first portion of the impression into place in the mouth. This precludes the possibility of distorting the impression. The parts are then assembled, boxed and the cast poured.

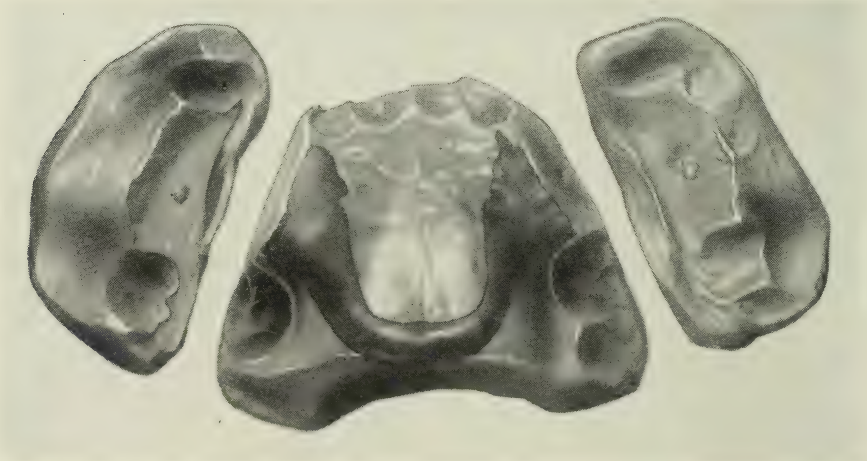


Fig. 82. Parts of impression of Class III, modification I, upper. Note wax used to rebase the saddle and bar impression, instead of compound wafer.

Class III, Modification I, Upper.

Class III, modification I, upper, presents no difficulty that has not already been mentioned in the other classes. It simply leaves us with two openings, one on each side of the mouth. Generally the impression can be taken in three sections. (Figs. 80, 81 and 82.)

The same principle holds true as in a Class III case, except that it is complicated by saddles on the opposite side and sometimes in the front of the mouth.

Class III, Modifications II and III, Upper.

These modifications can be handled in the same manner and it will never be necessary to make more than three sections of the buccal and labial impressions. The only difficulty we have in these cases is holding the parts in place, while the next section is being taken. The first section can be held in place very readily (see Fig. 43) by placing some compound on the bottom of the tray and having the patient bite into it. While the patient is biting into the compound, the dentist can give his undivided attention to taking the impression of the buccal and labial surfaces of the teeth. As each section is taken, it should be cut with a sharp

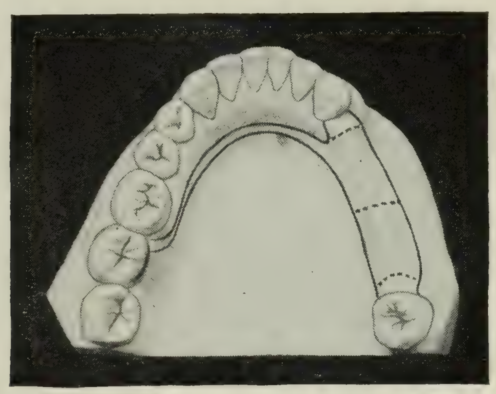


Fig. 83. Cast of Class III, lower.

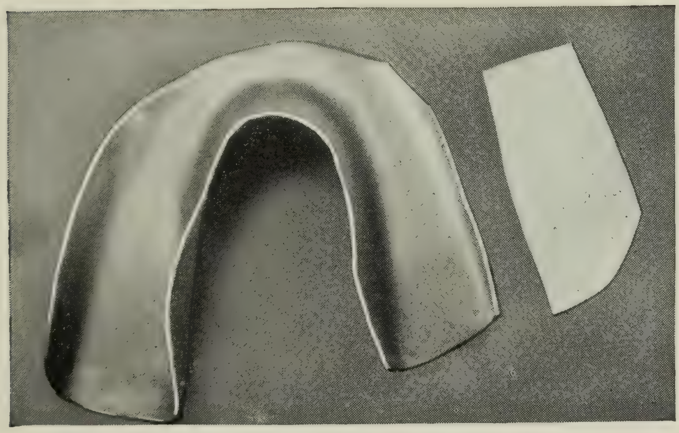


Fig. 84. Impression tray cut for Class III, lower.

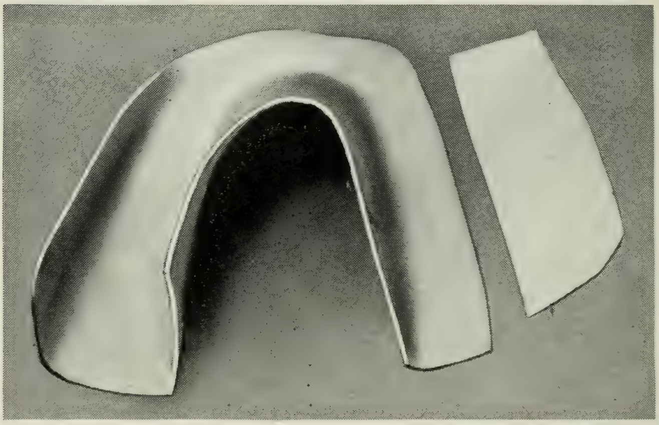


Fig. 85. Impression tray cut for Class III, lower, where tooth posterior to the saddle area inclines to the lingual. Note impression cut to allow compound to draw.

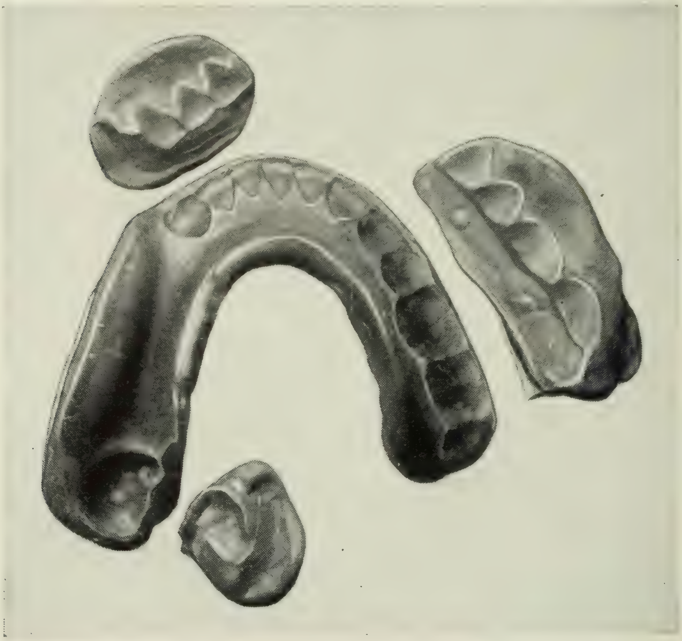
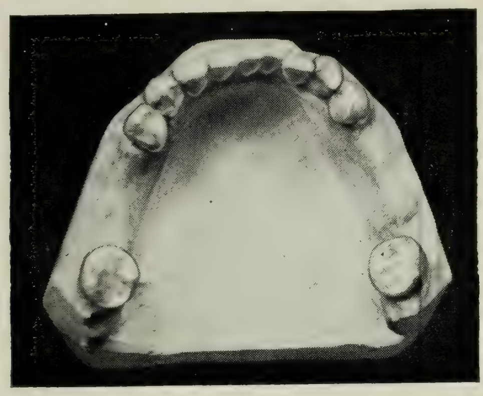
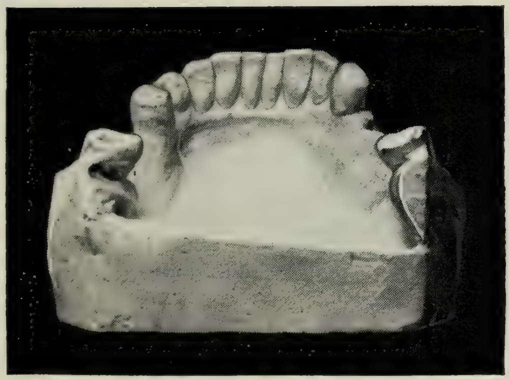


Fig. 86. Impression of Class III, lower. Note the impression of the lingual side of the tooth posterior to the saddle area.

knife, and it should be fitted back into the mouth to see that it goes back into place accurately. If these buccal and labial sections are chilled very thoroughly with air, they come away without distortion, and they do not



A.



B.

Fig. 87. A. Cast of Class III, modification I, lower. B. Rear view of Cast of Class III, modification I, lower, showing tipping of molar teeth.

adhere to the first section, if the first section is wet before it is placed into the mouth.

Class III, modifications II, III and IV, upper, are the most difficult impressions we have to take in the upper jaw, but I have never had one that required more than four sections, whereas, when taken in plaster, they sometimes break up into a dozen pieces and almost drive one to distraction when attempting to fit them together.

Class III, Lower.

The tray is cut to include the occlusal and labial surfaces of the teeth and the ridge. (Figs. 83 and 84.) If the posterior tooth is short and tapering and will not permit clasping, or if it is not to be used for clasping, a tray can be cut so that both sides of the ridge can be taken at the same time. This will then be similar to the manner of taking Class II impressions, disregarding the drag of the compound over the contour of the teeth. (Fig. 85.)

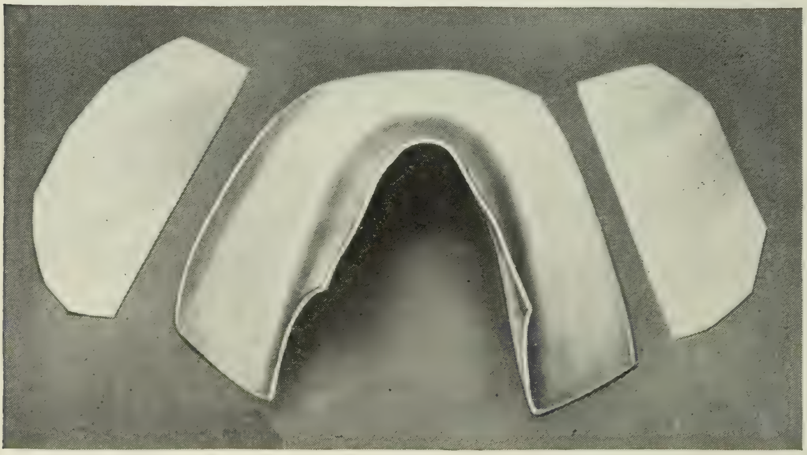


Fig. 88. Tray cut for Class III, modification I, lower. Note notches cut opposite the lingual surfaces of the molars.

Where the tooth has a decided lingual inclination and we hope to clasp it, the tray can be cut to include the entire saddle area, the occlusal and labial surfaces of the teeth and the occlusal and *buccal* surfaces of the teeth which are posterior to the saddle. The labial side of the tray opposite those teeth posterior to the saddle area, is removed, and when the impression is taken, any drag is disregarded until the impression is finished. Then the portion which drags is trimmed, so that the compound is at right angles to the lingual surfaces of the teeth. The first section of the impression is replaced in the mouth, and a small cone of compound is forced against the lingual surface of the tooth to be clasped. The impression is then assembled, boxed and poured. The most difficult of these impressions can be taken in five sections.

Class III, Modification I, Lower.

In taking an impression such as is shown in Fig. 87 A and B, where the posterior teeth lean towards one another, and we want to use them for clasping, the tray is cut so that it will include the lingual surface of the anterior teeth, and the lingual and occlusal surfaces of the posterior teeth, but the portion covering the lingual surfaces of the molars is cut away, to allow the compound to drag when the impression is removed from the mouth. (Fig. 88.) The impression is taken by forcing the blank on the study model and then reheating with the mouth blowpipe as described in other cases, placing into the mouth in the same manner as for other impressions and chilling sufficiently to allow its removal. This is done by degrees to relieve it of undercuts. It is then trimmed so that it will go in and out of the mouth easily. It should then be tested for rocking. If the saddle areas are extensive and there is a rock, they can be rebased in a similar manner as other impressions. If the saddle areas are not very large, it is better to rebase them with the carding wax. If the posterior teeth are to be clasped, the compound is cut away with a sharp knife where any drag occurs on the lingual surface, and the impression taken with a small cone of compound in the manner described where impression cones are used. Generally the lingual drag in these cases can be disregarded on the posterior teeth as it is seldom necessary to clasp them. (Fig. 89.)

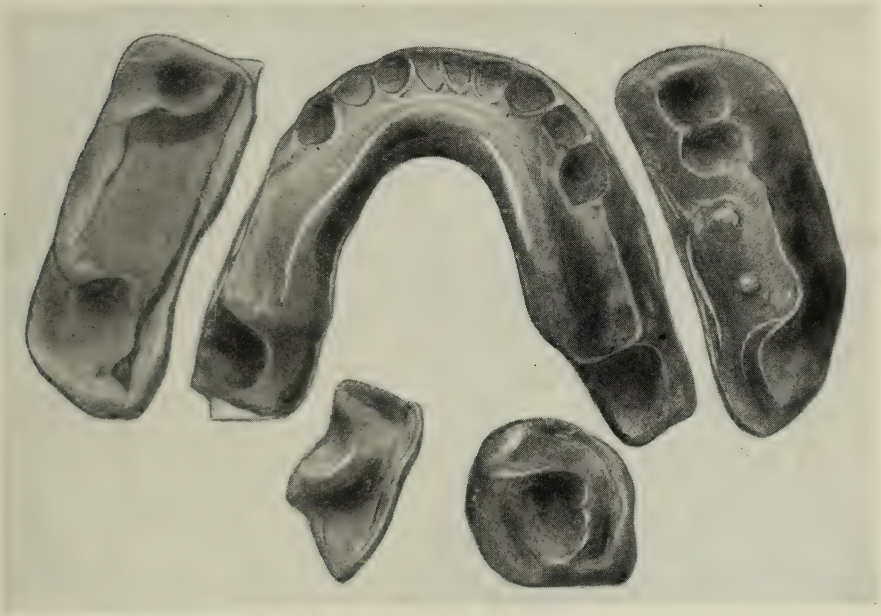


Fig. 89. Parts of impression of Class III, modification I, lower.

Class IV, Upper.

In Class IV, upper cases, we cut the tray to include the occlusal and labial surfaces of the teeth and the palate. (Figs. 90 and 91.) The first section of the impression is taken as described for other cases. The buccal and labial sections are taken in the same manner and it will generally be necessary to take these in three sections, making four sections in all for this

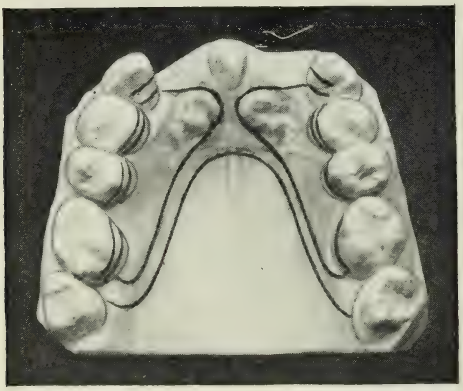


Fig. 90. Cast of Class IV, upper.

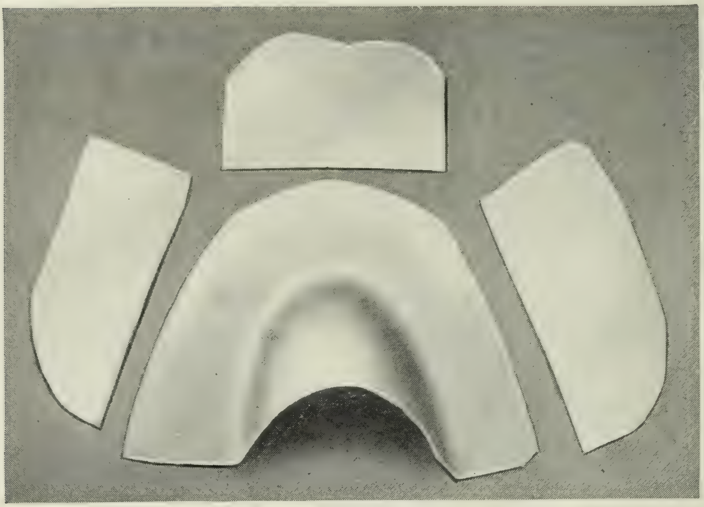


Fig. 91. Tray cut for Class IV, upper.

impression. As we do not depend on saddle support in these types of cases, it is unnecessary to rebase the saddle areas. (Fig. 92.)

Class IV, Lower.

The Class IV, lower impression is taken by cutting the tray to include the occlusal and lingual surfaces of the teeth, and the impression of these surfaces is taken first. (Figs. 93 and 94.) Then the buccal and labial surfaces are taken, after having trimmed the first section of the impression with a sharp knife to obtain good separating lines. These impressions are generally obtained in four sections. (Fig. 95.)

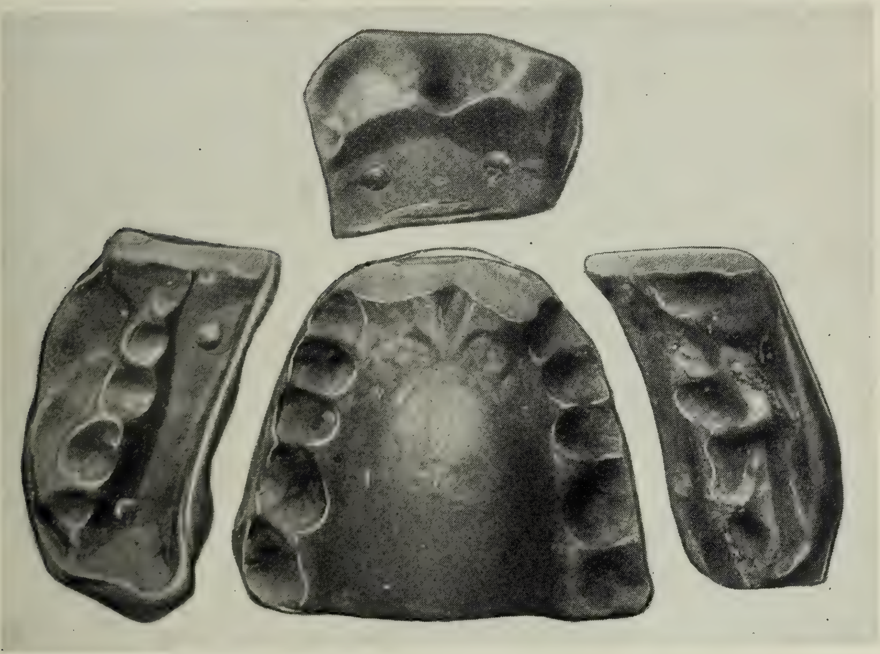


Fig. 92. Parts of impression of Class IV, upper.

If the teeth to be clasped lean a great deal towards one another, the attachments which are to be applied to them must be made first, (especially if we are using Jackson cribs), and the impression is then taken over them. This is done as previously described in Class II and III, lower cases, and in this event it will not be necessary to include the buccal surfaces, but it will be necessary to include the labial surfaces of the anterior teeth and the saddle so that we can get the relation of the teeth with those to be supplied. In my practice, for this type of work, I always construct a bar case with resting lugs on each side of the space, and extend the bar as far back as is feasible, to give balance.

Exceptional Type, Upper.

There is a type of Class IV impression which might be considered as a border line case; that type where there is only one tooth remaining on each side of the mouth. In the upper jaw we generally find that the second molars are the teeth which remain. The saddle is entirely anterior to its support but it will be necessary in this type of work to include the tuberosities which are behind the second molars. In the construction of this type of work, if we do not include the tuberosities and depend on the clasp to hold the plate up, we will find that we have planned a mechanical impossibility, and the plate will keep dropping. But if we extend small saddles back of the remaining teeth, taking the impression under compression, we will obtain an indirect retention which will hold the plate firm in position. The clasp should be so designed as to encircle the tooth, and the ends should be free from the plate so as to allow for adjustment. The impression tray is so cut as to include all surfaces of the saddle area and the teeth, except the buccal and the impressions of these buccal surfaces are taken with small pieces of compound, forced against them while we hold the first section in place. The compression over the tuberosities is best accomplished by means of carding wax, and at the time when we are obtaining this impression, we can post-dam the part across the entire posterior border of the plate outline. The plate outline in this case would be the same as in an impression for a full plate; at a line running at the juncture of the soft and hard palates.

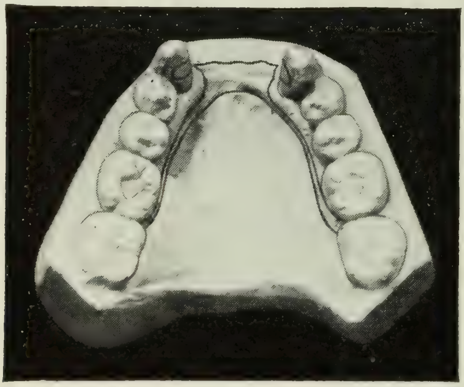


Fig. 93. Cast of Class IV, lower.

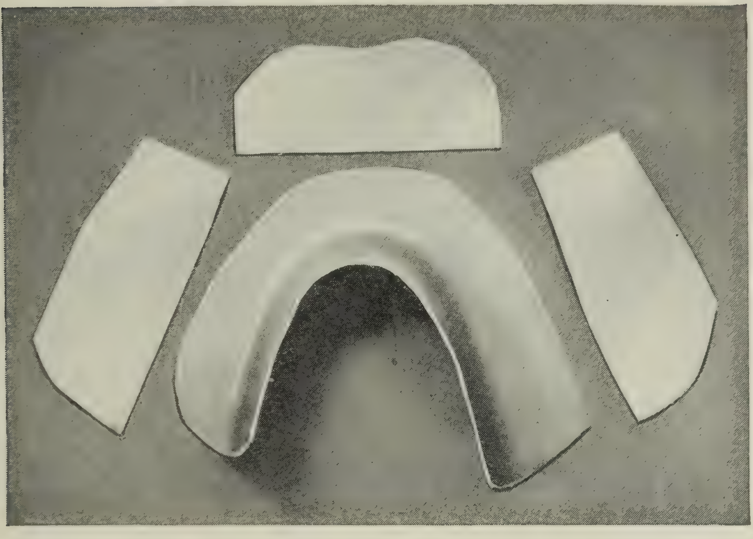


Fig. 94. Tray cut for Class IV, lower.

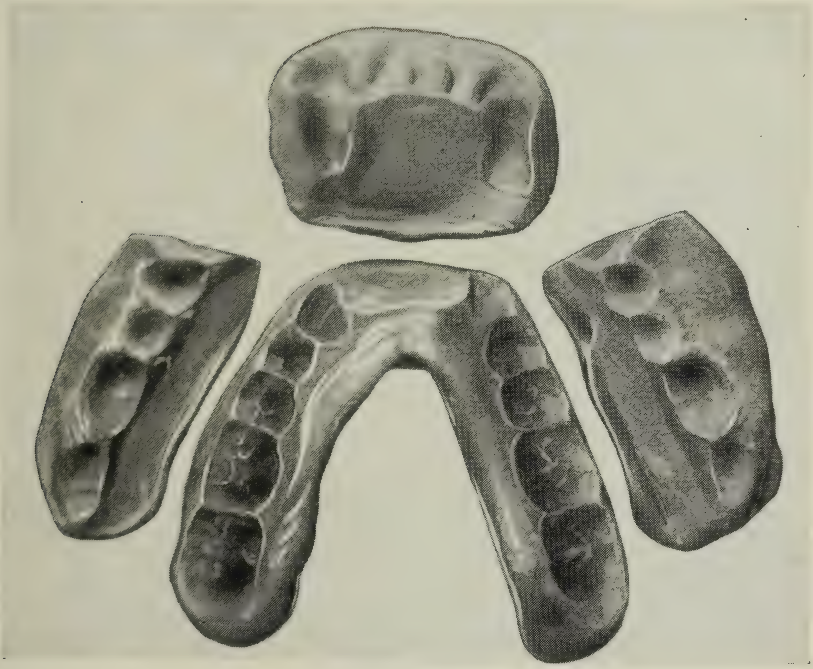


Fig. 95. Parts of impression for Class IV, lower.

Exceptional Type, Lower.

In the lower, we find the same condition, usually the second molars being the teeth remaining, but as a rule, we have no resting places distal of the molars similer to the tuberosities to provide indirect retention. We are not troubled here with the plate dropping, hence in many of these cases we obtain excellent results if we use some type of movable clasp attachment.

The impression can be taken in an ordinary No. 14 lower, S. S. White tray, or a tray of our own construction shaped similarly. If the impression rocks, it will be necessary to rebase the saddle area with thin sheets of compound. This is best done by cutting the compound to cover one side of the saddle area and another piece to be applied on the other side; the whole area is heated with the mouth blow pipe, dipped into hot water and put back into the mouth. If the teeth have a great lingual inclination, it will be necessary to cut the tray away from the lingual side of the teeth before taking the impression. The drag of the compound is disregarded until the rest of the impression is finished. Then the lingual surface is cut to allow it to free itself and an impression is taken of this surface, while the first part of the impression is held in place.

If we find a type of case which has three or four remaining teeth on each side of the mouth, and an anterior saddle is required, we will be obliged to plan attachments which will act as indirect retainers: hence, when our study model is made we must be careful to note the teeth that we intend to use for this purpose, and, when the final impression is taken, we must be sure that we get accurate impressions of these teeth.

CHAPTER VI

Plaster Impressions

I have stressed the importance of compound impressions and I believe that ultimately the majority of dentists will find them vastly superior to plaster impressions. I believe, however, that plaster impressions have their place and that a prosthodontist would be greatly handicapped if he did not know how to take plaster impressions.

A student should learn to take both plaster and compound impressions so that he may be able to select the method which gives the best results in his hands. Plaster has many disadvantages which I have mentioned before, but in obtaining relationship between two metal parts, as for example between saddles and the attachments, it is unexcelled. It is understood, of course, that the saddle has been constructed on another cast and that due consideration has been given to saddle compression.

Likewise, if the dentist employs a technique which requires the use of fusible metal teeth on the cast, to construct his clasps or inlays upon, he would find it impossible to pour the fusible metal into a compound impression.

Again, in the case of small bridges like the Nesbett type, where it is not necessary to consider saddle compression, the dentist may find it easier to take a plaster impression. In the case of orthodontic study models, which are to be used for future reference over a period of years, I believe that time can be saved by taking plaster impressions, if these plaster impressions can be removed without breaking them into too many sections.

I was fortunately trained in the use of plaster, by Dr. A. DeWitt Grittman, who takes as fine a plaster impression as any one who has ever come to my notice. I will endeavor to describe his method of taking a plaster impression.

Dr. Grittman's Technique.

In the first place he is very careful as to the grade of plaster which he uses, keeping it in a closed receptacle to protect it from the moisture of the air.

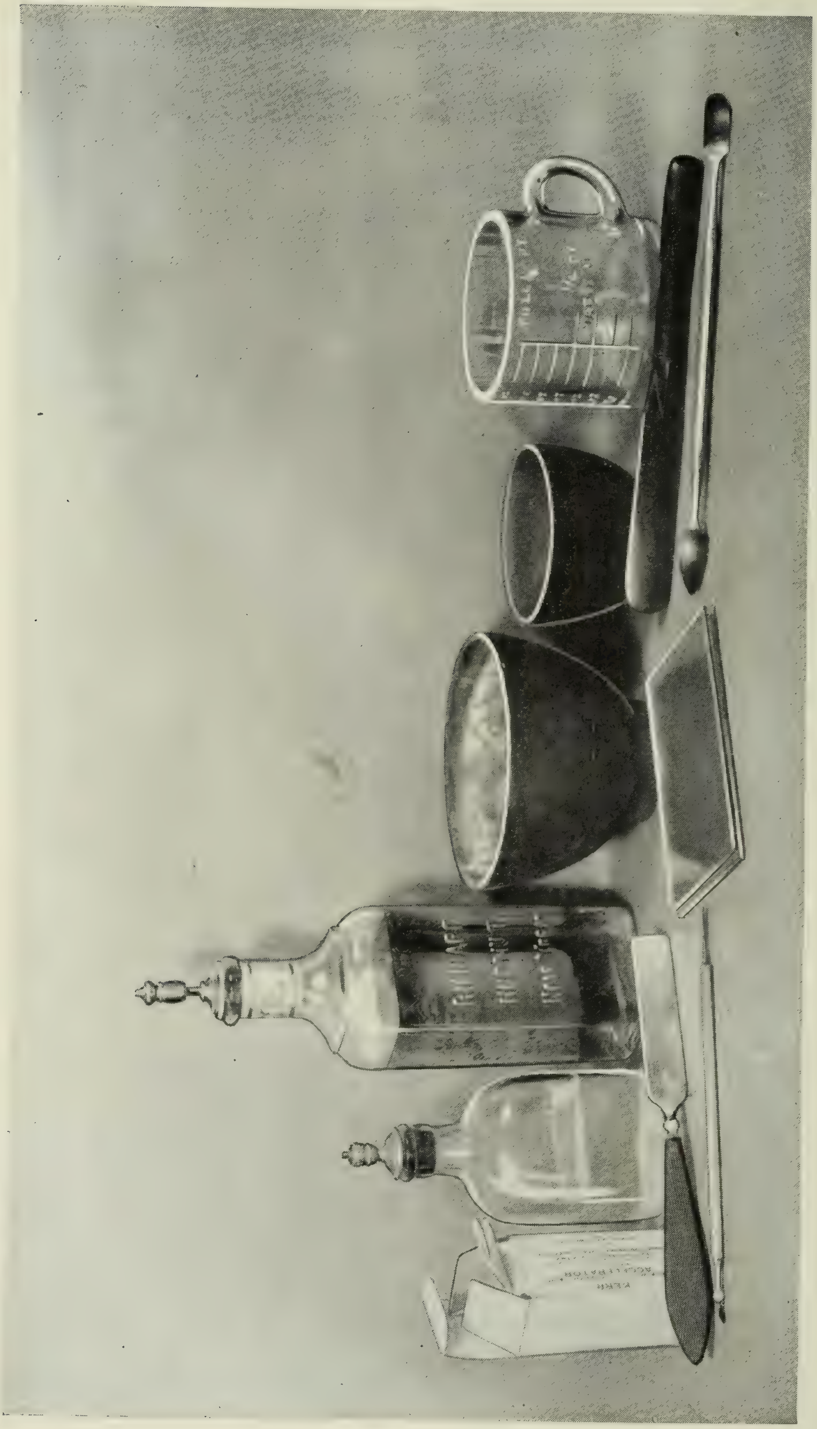


Fig. 96. Instruments and accessories for mixing plaster and pouring casts.

Each new can of plaster is tested to determine its setting time. This is important as some plasters set very slowly, in fact too slowly to get proper results, and others set very rapidly. To overcome the slow setting plasters, a hastener is used which consists of potassium sulphate and not salt. A quantity of water is carefully measured and likewise the quantity of plaster. The water used is tepid, about body temperature, and it is colored and flavored by the addition of a few drops of aqueous solution of carmine in violet water. The plaster is sifted into the water until all the water is absorbed. It is thoroughly spatulated, to remove air bubbles, with a side to side, cutting motion, rather than a circular motion. The bowl is held in both hands and pounded on the bench to cause any air bubbles to rise to the surface. The whole operation should occupy not more than three minutes, and it is seldom necessary to make a second mix of plaster, as each step is nicely calculated to produce the proper results. If the student will do a little preparation and obtain instruments and measures which are described in the following text, he will save much time and the embarrassment of having to go back to the plaster bench and mix another batch of plaster.

It will be necessary to obtain the following articles to properly take a plaster impression.

(1.) Two sizes of plaster bowls, (Fig. 96) one for large impressions and one for small impressions such as for crowns and bridges. It is not necessary to mix large quantities of plaster for a small impression as that wastes both time and materials.

(2.) A plaster spatula, which is kept for the purpose of taking impressions only, the average laboratory plaster spatula being a sight which no patient would care to behold. There are black rubber spatulas (Fig. 96) made for this purpose and sold by the dental supply houses. I have one made from a druggist's preparation knife (Fig. 96) ground to the proper shape.

(3.) Two glass measuring cups for the plaster and water. (Fig. 96.)

(4.) Bottles for coloring and flavoring matter and a bottle for potassium sulphate if used in solution. (Fig. 96.)

(5.) Separating knives. Fig. 97 shows one devised by Dr. Grittman and manufactured by the S. S. White Company and also by the Cleveland Dental Company. The other one in the illustration was ground from an old carving knife. A penknife answers very well, but it must have a strong blade and care must be taken that it does not cut the patient.

(6.) A white enamel dish should be provided, (Fig. 97) the bottom of

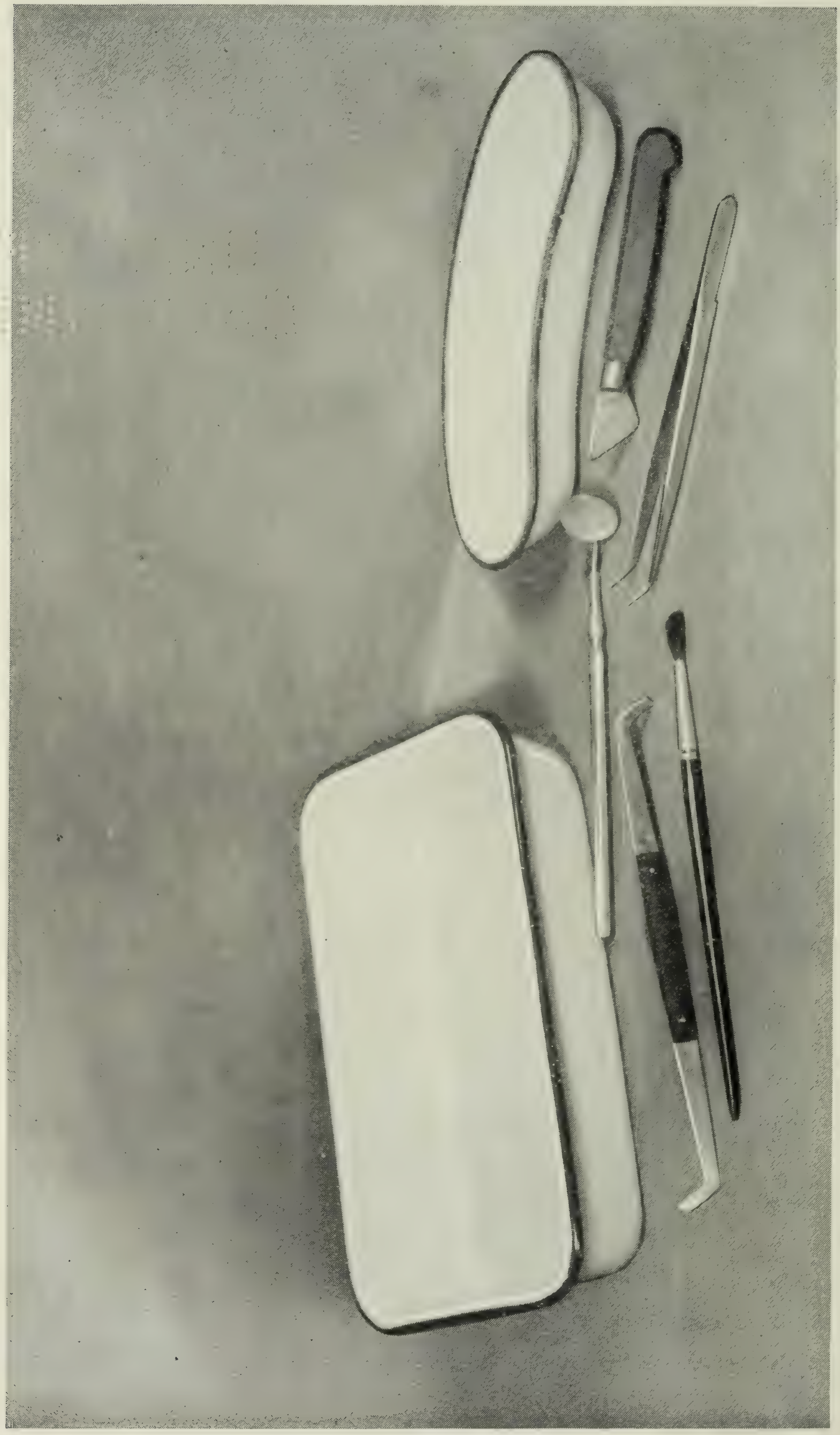


Fig. 97. Instruments and accessories for taking impressions at the chair.

which should be covered with blotting paper on which to place pieces of the impression as each is removed from the mouth.

(7.) A pair of college pliers. (Fig. 97.)

(8.) Some camel's hair brushes (Fig. 97) to remove small pieces of plaster which may adhere to the impression when we are piecing it together.

(9.) Wax spatulas.

(10.) Mouth mirror, (Fig. 97) which is very handy to remove a piece of plaster that has dropped on the patient's tongue, when it is in a semi-soft condition.

(11.) A good grade of shellac and sandarac varnish for separating, or any good separating medium which the dentist may prefer. A number of these can be made by the dentist, the formulas for which may be found in Prinz's Formulary.

(12.) Some glass slabs about three and a half inches square (Fig. 96) to use when pouring the cast to give a smooth surface on the bottom. Old lantern slide plates serve for this purpose.

(13.) A sufficient number of impression trays should be provided, to fit mouths of different sizes. The author has found that the most universal are the S. S. White Nos. 12, 14, 23½ and 30 (Fig. 98) and for the other sizes I prefer the orthodontia trays Nos. 21, 22½ and 23 upper, and Nos. 24, 25 and 26 lower. (Fig. 99.)

(14.) A basin to catch pieces of plaster or saliva if cuspidor is not conveniently placed for taking of the impression. (Fig. 97.)

(15.) A covering for the patient in the form of an apron.

(16.) A tube of vaseline should be provided to lubricate the trays so that they can be removed easily from the plaster when it is necessary.

There are a number of very good grades of impression plaster on the market. S. S. White's, Kerr's, Wiggan and Co.'s Clover Leaf, and a number of other firms supply impression plaster in cans, which keeps it dry and gives a mix much more uniform than that which is obtained in barrels.

The student to familiarize himself with impression taking, should begin by making practice mixes, using the measuring cups and determining the proportions of water and plaster needed to make a smooth mix. The proportions are approximately, water one part, plaster two parts by volume.

The water should be placed in the bowl and the plaster gradually sifted into the water. It is not necessary to use a sieve, as the plasters above mentioned have all been carefully screened. The plaster should be so distributed in the bowl, that it is even with the surface of the water and not piled up, part of it standing out of the water in a semi-dry condition, as that will

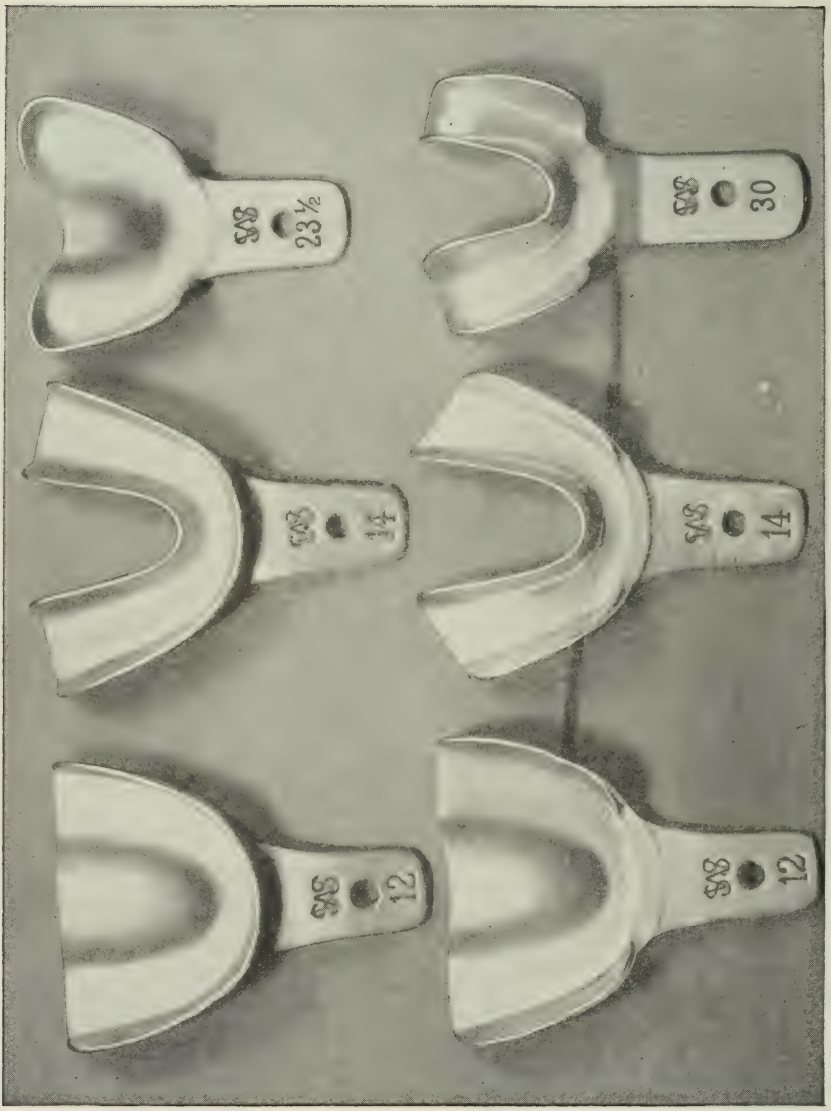


Fig. 98. Plaster impression trays. Lower row Nos. 12 and 14 have front cut out. No. 30 can be purchased ready for use.

cause lumps when it is mixed. No accelerator is used in this test, because we want to determine what time the plaster requires to set thoroughly. The test only need be made once for each can of plaster.

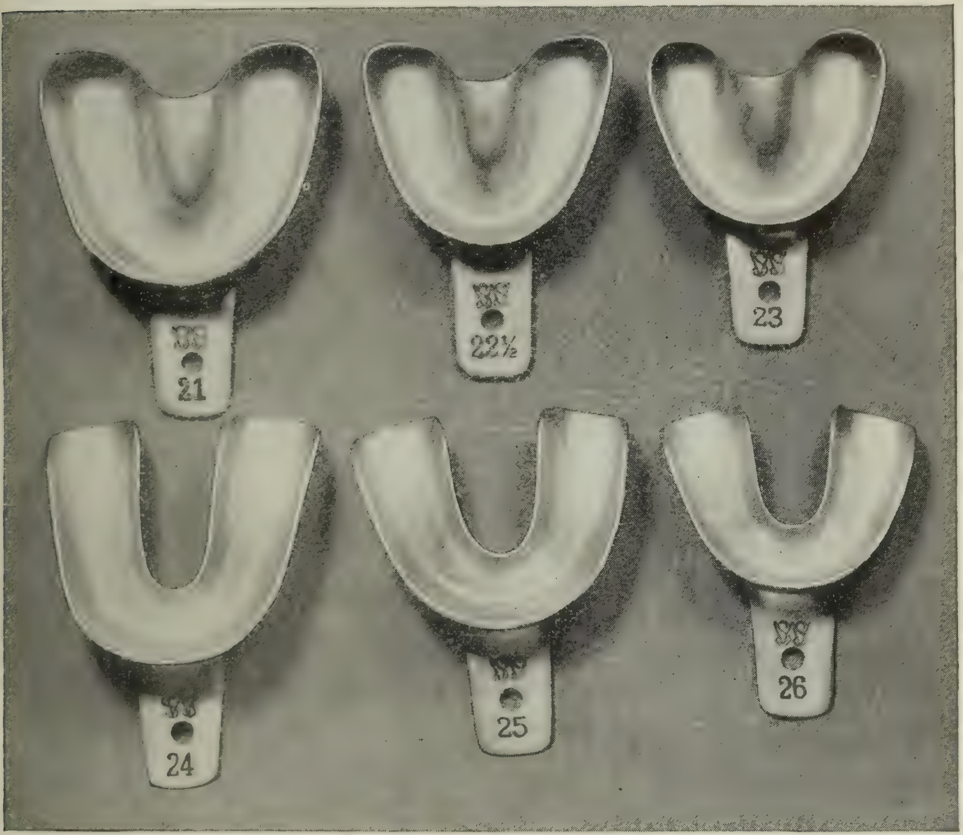


Fig. 99. Plaster impression trays, used in Class II, III, IV and their modifications and modifications of Class I.

After sifting, the plaster is spatulated from side to side, not with a circular motion. The circular motion has a tendency to draw air into the plaster and to form air bubbles. After a half minute of this motion of the spatula, the bowl is grasped firmly with both hands, and jarred on the bench in order to bring any air bubbles to the surface. A spatula-ful of the plaster is then taken out and dropped on a glass slab. If it is of the proper consistency it will not spread to any great degree. When the next spatula-ful is spread, it will build up into a cone about an inch in diameter and three inches high if nicely mixed. (Fig. 100.) When it has set hard enough to fracture, the time should be noted, estimating from the time when we begin stirring the plaster, to the time when it has set to the degree of hardness wanted. If it sets nicely in about five minutes, no accelerator is needed. This will allow you one minute for mixing, one minute to pour the mix into the tray and get it to the mouth and three minutes to set in the mouth. If it takes longer than this, the plaster needs some accelerator.

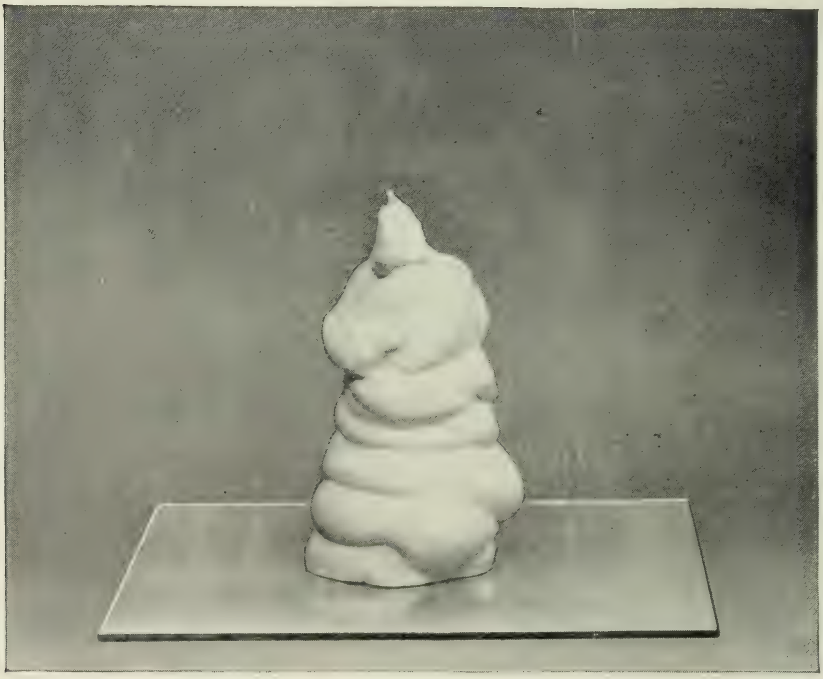


Fig. 100. Test of impression plaster.

I have found that in dripping the plaster off the spatula, it has a smooth appearance when properly mixed, but if it is examined very closely, it will be found that it has a number of very fine lines running across the surface cutting across one another. These are not indentations, but rather surface tension lines, and are always an indication of a good mix of plaster.

Potassium Sulphate Accelerator.

If the plaster takes five, six or seven minutes to set after it is on the slab, that would be too long for the comfort of the patient, and it is best to use an accelerator of potassium sulphate. Never use salt as it will cause the impression to "fur up." It will appear white and fuzzy if the impression is allowed to stand over night. The Detroit Dental Manufacturing Company sells an accelerator, in the form of powders, known as "Kerr's Accelerator." These are weighed and the student is sure of using the same quantity of accelerator each time. If he does not wish to purchase these, he can use Dr. Grittman's method of purchasing potassium sulphate crystals from the chemist, and making a saturate solution of this in a stock bottle, pouring off a sufficient quantity of it into an empty glyco-thymoline shaker bottle (Fig. 96) which is kept at the plaster bench and which delivers an equal number of drops each time it is shaken. The stock bottle may be refilled with water, from time to time, until all the crystals have dissolved.

By using it in the manner above described, you get none of the small undissolved crystals into your impression. In using the powders they are dissolved directly in the water in the plaster bowl. The quantity used must be regulated according to the time in which we want the plaster to set. I would advise each student to practice this, until he has the time gauged accurately, as it is important that he should not be bothered by the fast, or slow setting of the plaster when he is taking the impression.

Flavoring and Coloring Agents.

The flavoring and coloring matter may be added to the plaster at this time, if so desired. Some men use a few drops of oil of wintergreen in the water, and others use oil of cinnamon. Dr. Grittman uses violet water, which is colored red with an aqueous solution of carmine.

The aqueous solution of carmine can be prepared by the druggist, or can be made in the laboratory by dissolving one ounce of powdered carmine in five ounces of ammonia water (household). Allow it to stand until the fumes of ammonia pass away. Take a four ounce bottle of violet water, pour out one ounce, and replace this with one ounce of the above solution. Any coloring matter which is non-poisonous and soluble in water may be used. It is an advantage to have the plaster colored and flavored, as it is an aid when we come to separate the impression from the cast, making it an easy matter to distinguish between the impression and the cast. It also has a pleasing odor and flavor and has a tendency to prevent nausea.

Preparation of Patient

It is highly important that the patient should be prepared before we begin to mix the plaster, as no time must be lost in getting the mixed plaster from the bench to the patient. A few seconds lost at that time may mean a spoiled impression.

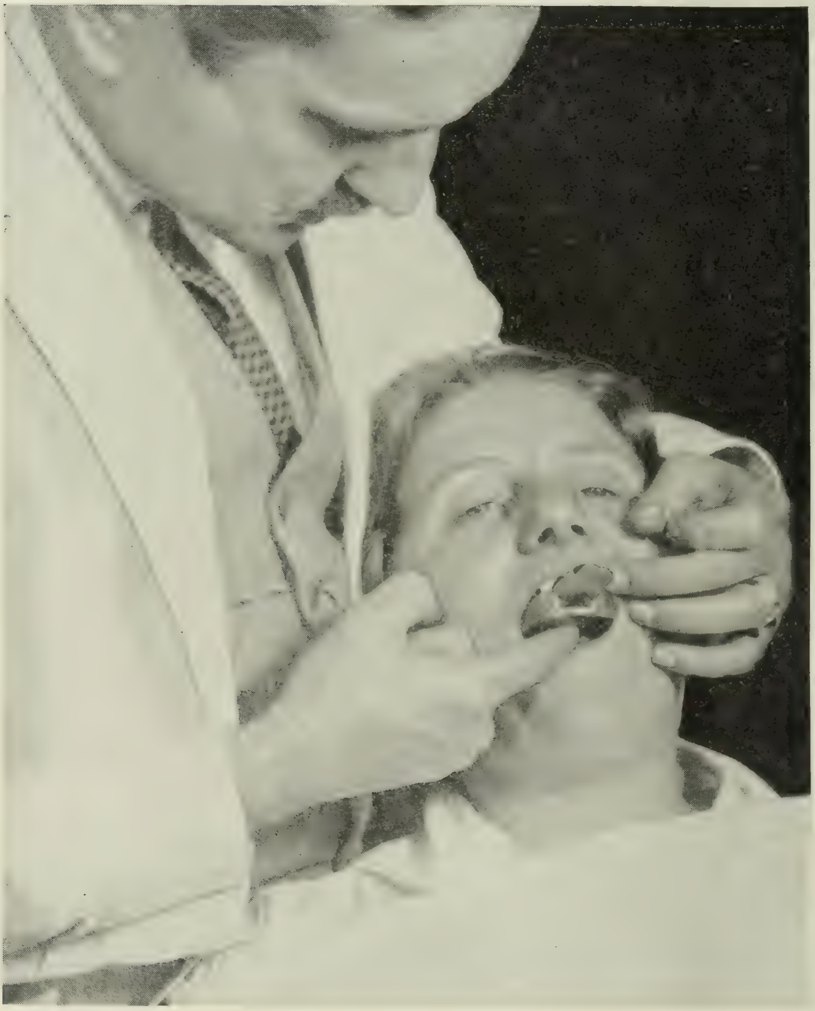


Fig. 101. Upper impression. Correct position of patient and operator.

For the upper impression the patient is placed in the chair so that his mouth is on a level with the operator's elbow. (Fig. 101.) The patient should be in an upright position with the head tipped slightly backward. There is a common notion that if the head is tipped backward, plaster may drip into the throat, or pieces might break off and cause choking, coughing or gagging, or even be swallowed. In such contingency the patient is apt to become panicky and to bend the head far forward with the intention of preventing the particle of plaster from slipping down the throat. As a matter of fact, when the head is tipped forward, swallowing is readily accomplished, whereas if the head is tipped far backward, swallowing is impossible. Before placing the tray with plaster into the mouth, all this should be fully explained, and the patient should be made to try to swallow with the head first far forward, and then far back. Moreover, the dripping of plaster into the fauces is always due to using too much plaster, which consequently should be avoided. The breaking off of small particles at the palatal back edge of the impression, cannot occur until the plaster has partly set, and prior to that time all excess of plaster should have been wiped away, leaving the soft palate absolutely clean. The technique for this will be explained presently. As a protection to the clothing, the patient should be covered with a fairly large towel, or preferably with an apron.

The cuspidor should be in such a position that it can be swung around in front of the patient in case of gagging and choking, but if you have the pedestal type of cuspidor, this cannot be done. In such circumstances (see Fig. 97) have the basin provided for the purpose at hand, as it is impossible to leave the impression while it is in a semi-plastic state. If you have an assistant, she can take care of the basin, but if you have none, let the patient hold it. It will give him something to think about and keep his mind off of the impression.

Prior to placing plaster in the mouth, it is well to have the patient demonstrate his ability to breathe through the nose, because if through any misadventure, mouth breathing should be occluded, a sudden command to "breathe through your nose," may cause him to become so panicky that he might really be unable to obey, responding with short gasping breaths, which only increases the difficulties and might even make it necessary to remove the impression. This should be avoided at all hazard, if possible, as it will make the second attempt even more difficult because of the patient's mental anxiety. This request in advance to demonstrate breathing through the nose, will also disclose whether the patient is suffering from any nasal obstruction, in which case extra precautions must be taken against impairing his ability to breathe through the mouth. If the patient should show some dread that he might not be able to "breathe with all that plaster in the mouth," it should be explained that the plaster will be handled so that he will be able to breathe easily throughout the entire operation. The mental preparation of the patient is quite important, because practically all troubles that arise during impression taking, are psychical rather than mechanical. In other words, with a proper technique there should be no difficulty, except in the rarest instances.

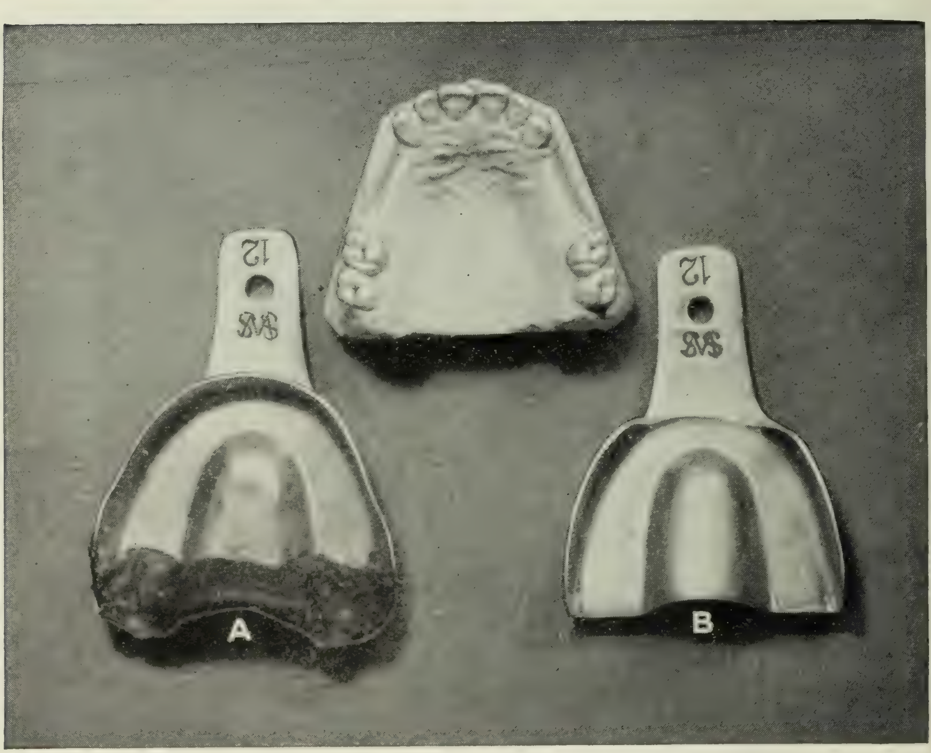


Fig. 102. Cast of a Class III, modification I, upper, case. A. Tray with posterior border built up with wax. B. Tray with labial portion removed, which is desirable when strength in the cast is required in this region.

Selection of Tray. Next we should select the tray. For plaster impressions I prefer a stiff tray to a flexible one. The flexible trays are liable to bend when removing them from the mouth, and we do not get an accurate fit when placing the impression back into the tray.

I will describe the method of taking a Class III, modification I, upper impression as it is most typical.

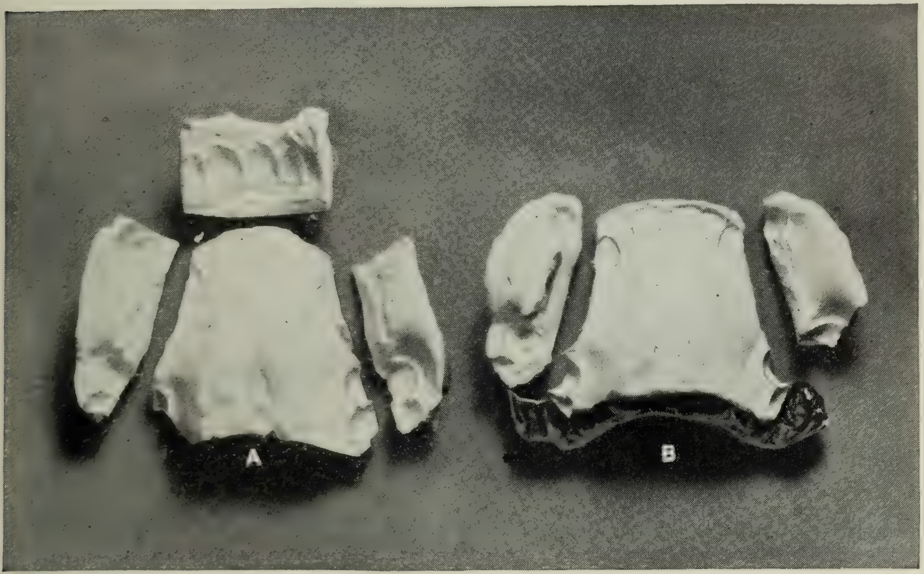


Fig. 103. Impression of a Class III, modification I, upper, case. A. Result when labial portion of tray is not cut away. B. Result when labial portion of tray is cut away, and posterior border built up in wax.

Impression for Class III, Upper, Modification I.

A No. 12 S. S. White tray is the one most universally used, although in an exceptionally large case, a larger tray will be required. The tray is cut, (see Figs. 98 and 102) removing the labial flange, with a pair of cutting pliers, and smoothed with a vulcanite file and scraper, to give it a neat appearance and prevent scratching the patient's mouth. The tray should be tried in the mouth to see that it is sufficiently wide.

If it is not wide enough at the back edge, it can be made slightly wider by placing it flat upon the anvil and striking it with a bone hammer on the curved palatal portion which will cause the tray to spread out. It can be made narrower by squeezing it between the jaws of a vice.

A quarter of an inch should be allowed between the teeth and the side of the tray for thickness of plaster. The posterior edge should be built up with yellow beeswax, (Fig. 102) and pressed against the palate. This will act as a compressor of the soft tissues at the back of the vault and will prevent an excess of plaster from going into the patient's throat. A much better impression is obtained when the wax is used, as the plaster is confined within the proper boundaries, and if this step of the work is nicely done, the patient is saved a great deal of discomfort. (Fig. 103).

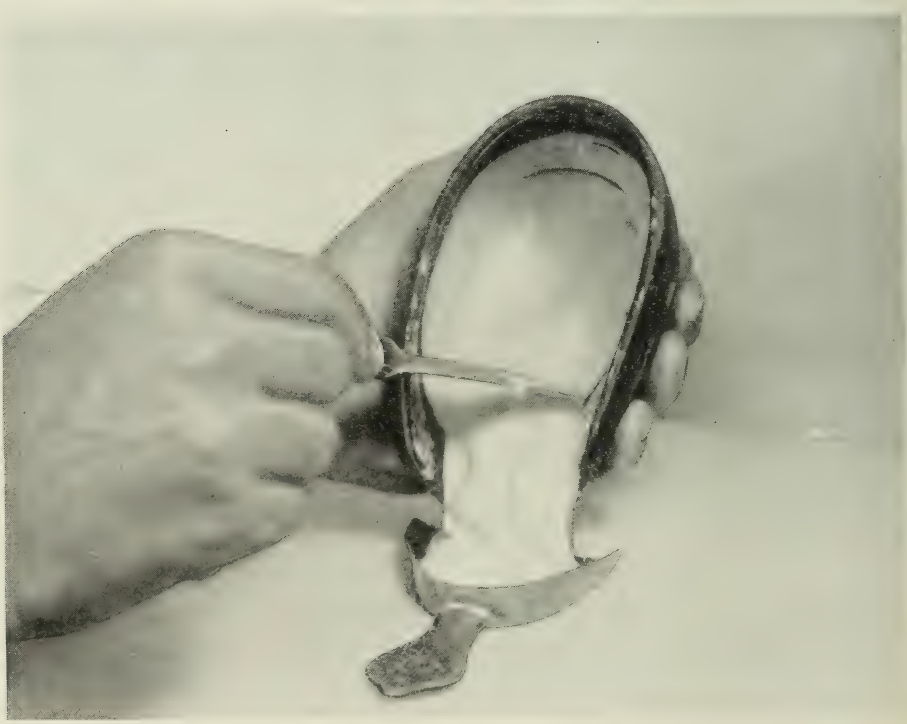


Fig. 104. Technique for filling upper tray with plaster.

When the tray is ready and everything is within easy reach, the plaster is mixed. At the completion of the spatulation, the bowl is grasped firmly with both hands and jarred against the plaster bench to release any air that has been confined in the plaster. The bowl is then squeezed with the left hand to form a spout and the plaster is poured into the impression tray, assisting it with the spatula. (Fig. 104). If properly mixed, the fine lines which I mentioned in relation to testing plaster, may be noticed at this stage. The plaster is piled up in the center of the tray sloping down towards the edges. (Fig. 105).

The tray is rotated into the mouth; that is to say, one corner is passed in first, the cheek on that side being distended with the tray itself; the opposite cheek is then drawn out of the way with the finger of one hand, and the tray turned into the mouth until it is intruded equally on both sides.

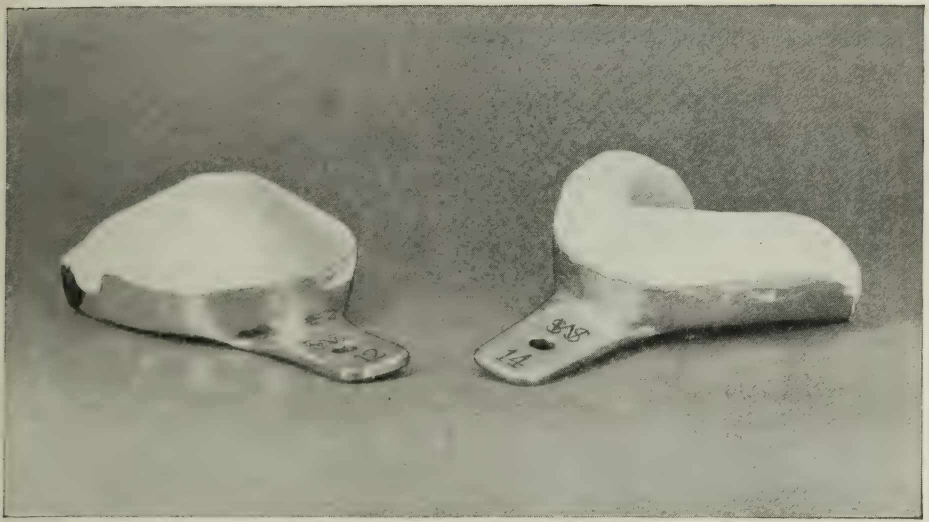


Fig. 105. Impression trays filled with plaster.

I usually introduce the right side of the tray first, and then hold the check on the left side away with the finger of the left hand. Some however might prefer to reverse the process, placing the left side of the tray into the mouth first.

If there is a very high vault, it may be necessary to apply a little plaster in the highest portion, with the end of the spatula, before the tray is put into place. If this is not done, air may be confined in this space and a large flat bubble formed, which will be difficult to correct.

Just at this point, the patient is directed to tip the chin up high. This gives the operator full view of the palate and the impression is now gently but firmly forced upward, so as to bring the wax at the back margin into contact with the tissues. Then, with a light waving motion the forward part of the tray is brought up to position. This waving motion causes the plaster to spread evenly over the surface of the vault and prevents the formation of air bubbles.

The impression having been firmly seated, it should be held immovable while the palate is cleared of any excess of plaster that may have oozed beyond the wax. This is accomplished with sticks (such as the orange-wood sticks), the ends of which have been wrapped with dry absorbent cotton. Several of these must have been prepared in advance. The dry cotton quickly grasps the excess plaster and removes it. By this technique there is no plaster left to fracture off during the setting and the patient breathes freely.

The cheeks are then manipulated with the fingers so that the plaster will be forced up into the buccal labial fold, and the surplus plaster will come out at the forward part of the tray. The tray should be forced upward so that you just miss touching the teeth.

If there is a great deal of surplus, some of it can be removed with the finger but the tray should never be released while the plaster is still soft, as a sudden motion, or gagging on the part of the patient, might force it out of position and spoil the impression. The patient's head is supported with the left arm, (see Fig. 101) until the plaster begins to set. When it can be broken with a sharp fracture, an upward pressure is exerted on the handle of the tray and if too much plaster has not been allowed to cover the labial surfaces of the cuspid teeth, the small pieces of plaster which cover these, will break away, and, as a rule, the impression can be removed from the mouth in three pieces.

The Class I, upper and lower, impressions are the only ones which are broken from the mouth, and they only, because there is such a small piece of plaster to fracture. (See Fig. 108). It is a dangerous procedure to break impressions out of the mouth if there are any large masses of plaster to be broken from the main body. I have seen a number of cases where teeth have been broken, or bridges removed, when this was attempted, to say nothing of frightening the patient.

Upon the removal of the impression, it should be placed in a pan provided for that purpose and the patient's mouth should be examined to see that no pieces of plaster remain. The student should examine between the teeth and at the tuberosities, as sometimes these pieces are lost. This examination should take place before the patient is permitted to expectorate. The mouth should then be sprayed with an antiseptic solution, and the patient made as comfortable as possible, and asked to remain until it is finally determined that all the sections of the impression have been recovered.

It will be noted that no impression has been taken of the labial surfaces of the teeth, except those which we intend to clasp, and it is not necessary to obtain impressions of these surfaces as we have no use for them in this type of case; moreover we have a very much stronger cast if, when boxing the impression, we allow for a greater thickness of plaster than we would if an impression of the labial surfaces of the teeth were taken.

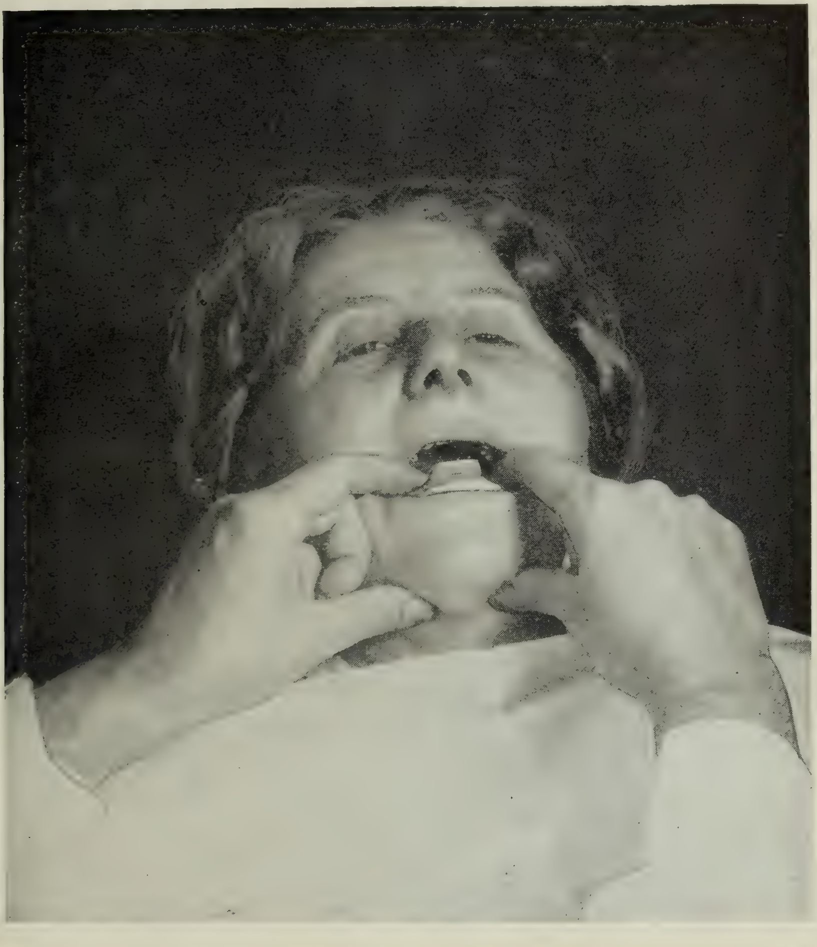


Fig. 106. Technique for lower impression with plaster. Correct position of patient. Method of firmly holding the impression during the setting period.

Impression for Class I, Lower.

The chair is raised so that the patient's mouth is on a level with the operator's shoulder. (Fig.106). The tray is cut in the same manner as for the upper, with additional cuts at the back buccal corners. (See Fig. 98, tray No. 14, lower row.) These corners are always too long and jam into the patient's cheek; they should be cut off at an angle of thirty degrees with the back of the tray. The tray is filled with plaster from the spatula in the manner shown in Fig. 107.

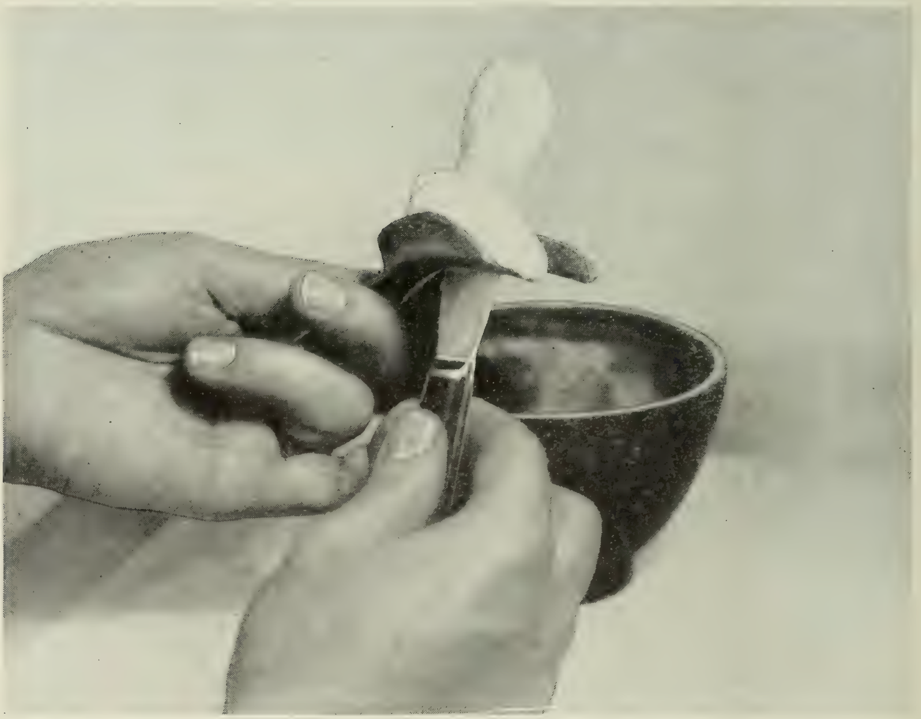


Fig. 107. Method of filling lower tray with plaster.

The dentist stands in front of the patient; the tray is held in an upright position and just before it enters the mouth, it is reversed. It is put in on the left side first and then the right, the left cheek being held away with the right hand. It is held in position by placing the fingers on the tray with the thumbs under the mandible. Held in this manner, the impression will not be disturbed if the patient moves the tongue.

It is seldom that a patient gags because of a lower impression. If he does, try to distract his attention by making him breathe hard through the nose, or tell him to let the tongue lie quiet. You will find, however, that if a patient gags a great deal with a lower impression, the impression is generally spoiled owing to the violent motions made with his tongue and we only deceive ourselves in making a plate on a cast from this sort of an impression.

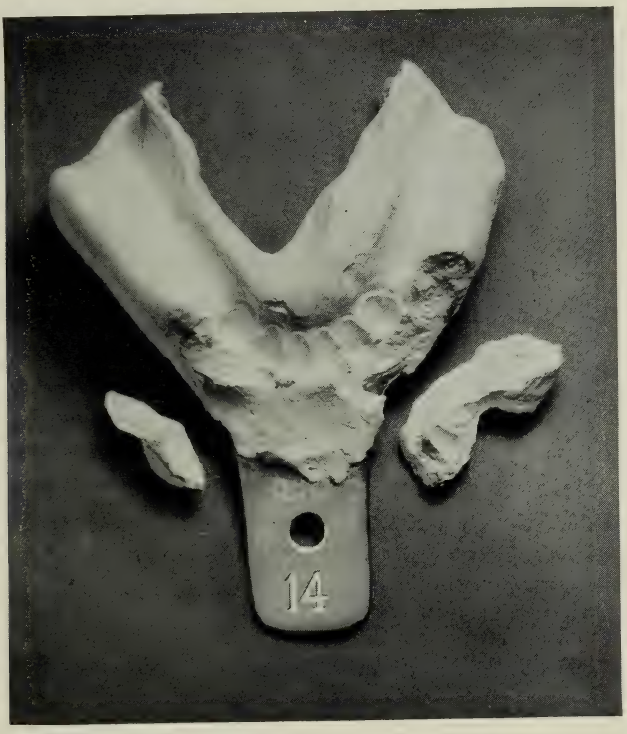


Fig. 108. Impression of Class I, lower, case. Pieces broken off are seen at the side.

Cleaning Away Excess.

As in the case of the upper impression, during the setting, all excess plaster should be removed with the swabs, (sticks the ends of which are wrapped with cotton). First wipe away the excess immediately under the tongue. This quickly gives the tongue more space and permits the patient to lower it away from the soft palate, against which it might be pressed because of a large mass of plaster lying in this region. With the tongue thus lowered to its normal position, the patient breathes more easily, and this alone removes most of the danger of gagging. Next examine the region at the back end of the tray, on each side. Here it will be seen that excess has probably oozed out. This should be wiped away while still soft, as after partial setting, any attempt on the part of the patient to swallow, may break off pieces of plaster which might fall into the throat. These more important localities having been wiped clean, next, with a moist sponge, cleanse away any particles of plaster that may have lodged about the patient's lips or face. This makes him more comfortable. By this time the plaster will have partially set, and the cheek, first on one side and then on the other, may be distended, and the excess plaster lying between the tray and the cheek may be cleaned away with the swabs.

The major portions of excess plaster having been removed, all smaller particles should next be cleared away, using first dry, and then wet, balls of bibulous paper, handled in the tweezers. At times it is even permissible to introduce the saliva ejector, and spray the mouth thoroughly, thus leaving nothing in the mouth but the plaster needed for the actual impression, and the tray which is perfectly clean. Whilst all excess of plaster, or stray particles, should be cleared away whether taking an upper or a lower impression, it is, perhaps more important that this should be done in the lower jaw, because the tongue is a busy member, and the smallest crumb of plaster may excite movements of the tongue that will interfere with the operator, compelling him at times to take the tray out of the mouth.

Removing the Impression.

In removing this impression from the mouth, we press downward on the handle of the tray which raises the impression up at the back, and releases it. As in the upper, the small pieces of plaster which are on the buccal side of the bicuspids, or cuspids, as the case may be, break off. (Fig. 108.) Care must be exercised if the teeth are frail, as you are liable to fracture them. As a rule these impressions come away in three pieces.

The modifications of Class I, upper and lower, should be handled in a manner similar to that described for other classes of impressions; that is by removing the tray and cutting the impression from the mouth, along predetermined fracture lines. I will describe a Class III, modification II, upper, which is probably one of the most difficult, and the student can apply the same principles to all other impressions.

Class III, Upper. Modification II.

The tray is selected and it makes no material difference whether the front is cut out or not. Personally, I prefer to have the front cut out, as it makes a stronger cast when it is poured. Two illustrations are shown;

one with the front cut out and one without. (Fig. 102.) The back of the tray is built up with wax. In taking the impression, the tray should be removed and the impression cut from the mouth; not broken as in a Class I case.

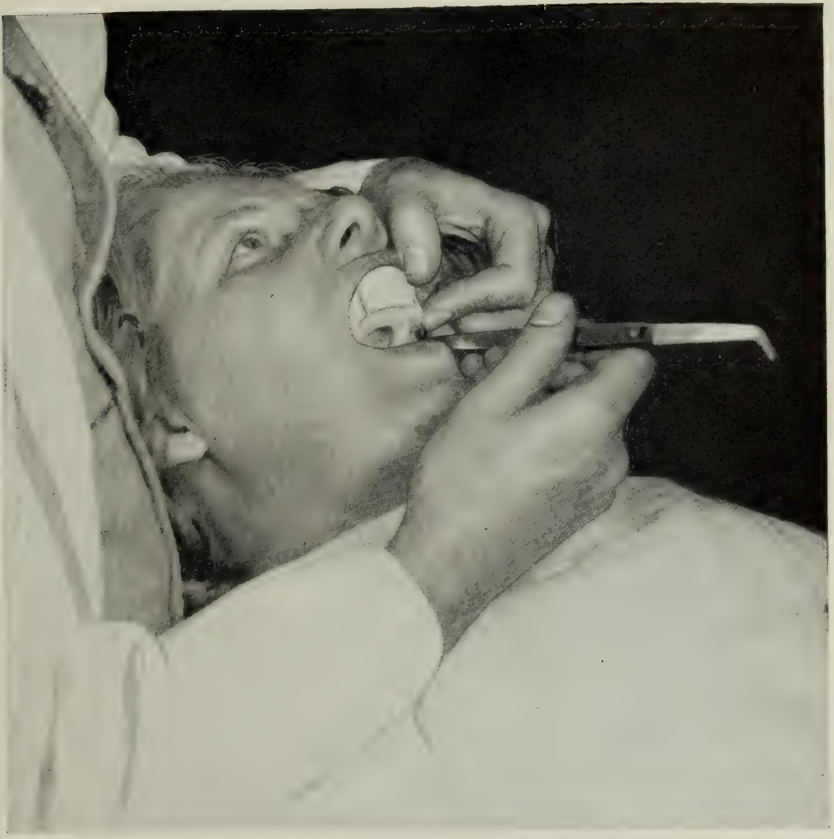


Fig. 109. Technique for cutting impression prior to removal.

The position of the patient is the same and as soon as the operator notices that the plaster left in the plaster bowl begins to break with a clean fracture, he can remove the tray from the impression by pressing downward on the tray, and at the same time exerting pressure on the back of the tray which is used as a fulcrum and prevents breaking the impression from the mouth.

One of the separating knives is selected and a line is cut along the occlusal surfaces over the bicuspids and molars, and along the incisal edges over the anterior teeth. (Fig. 109). This line is deepened at the open spaces between the teeth. Lines are then cut vertically on the buccal surface of the impression, along what would correspond with the long axes of the cuspid teeth. This separates the most difficult upper impression into four sections.

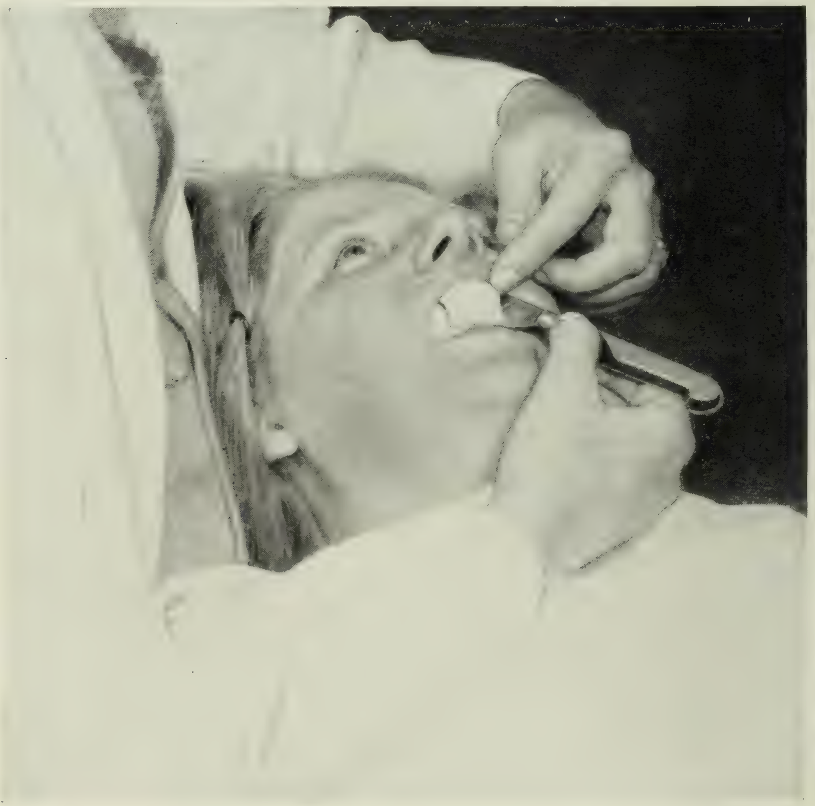


Fig. 110. Removal of labial section.

The knife is then placed into the vertical groove on the left side and with a twisting motion, the labial piece is pried loose. (Fig. 110). Next the labial sections are grasped with the fingers and pulled forward and downward. The palatal portion is likewise removed. If you use an instrument in removing the palatal portion, the college pliers closed up and forced into the impression at a point where there is a space between the teeth, gives us a good hold.

The pieces of the impression are placed in the pan used for this purpose, and the patient is not dismissed until we are certain that all the parts of the impression have been recovered. If the patient comes from a great distance, it is a good plan to have him wait until the impression has been assembled, thereby possibly saving him an extra trip.

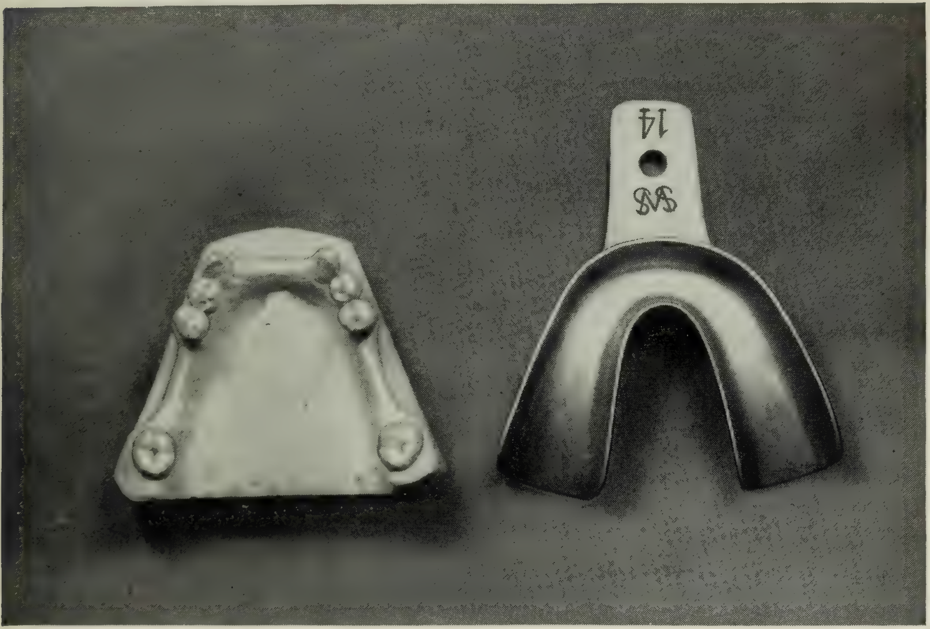


Fig. 111. Class III, lower, modification II, and impression tray suited to such condition.

Impression for Class III, Lower, Modification II.

The lower impression is taken in a similar manner, but sometimes in a Class III, modification I, lower, (Fig. 111) or Class IV, lower, after the buccal and labial sections are removed, it may be necessary to make another cut anteriorly and posteriorly through the median line of the impression, which extends through the opening between the remaining center teeth. (Fig. 112). In making this cut, do not cut down to the ridge, but leave a little space between, so that the impression of the ridge will not be marred. The lingual pieces of the impression are removed by forcing inward from the buccal to the lingual side which releases them from their undercuts.

Impressions for Small Bridges.

In taking impressions for Nesbett or Bonwill bridgework I use a type of impression tray which has a small swivel handle so that it can be used either on the right, or left side, or in the front of the mouth, and commonly

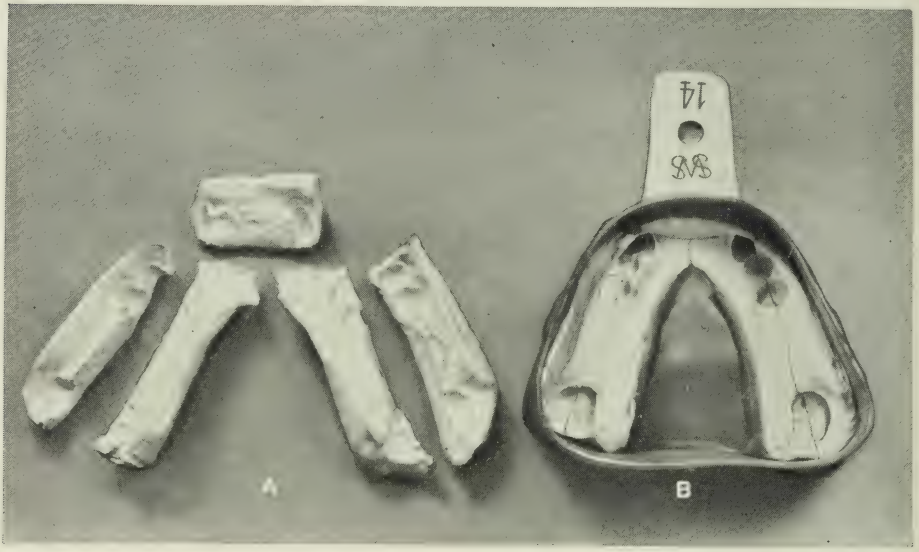


Fig. 112. Class III, lower, modification II. A. Impression before assembling. B. Impression assembled, and boxed ready for pouring cast.

known as "crown and bridge" trays. I much prefer to take the tray off the handle and cut my own shapes. The occluding teeth are taken in another and similar tray. The bite is taken in pink wax supported by aluminum or card board side pieces, which prevents the wax from spreading. (Fig. 113). These are obtained from the supply houses or made from sheet aluminum held together by dental floss. The one shown in the illustration is supplied by Supplee and Company of New York.

Assembling and Repairing Impressions

There are several methods of assembling impressions after the pieces have been broken, or cut out of the mouth. It was Dr. Grittman's custom to allow the parts of the impression to dry out for about twenty minutes, after which he used a camel's hair brush to remove small particles that might interfere with accurate rejoining of the several sections.

The pieces broken from the buccal and labial surfaces of the teeth are put back into position in the tray and held in place with wax. Any imperfections, such as air bubbles, or the loss of a small piece of plaster may be repaired by filling in with yellow beeswax. The yellow beeswax will flow into the air bubbles and hold while any surplus that may flow over the surface of the impression can be removed with a flat burnisher.

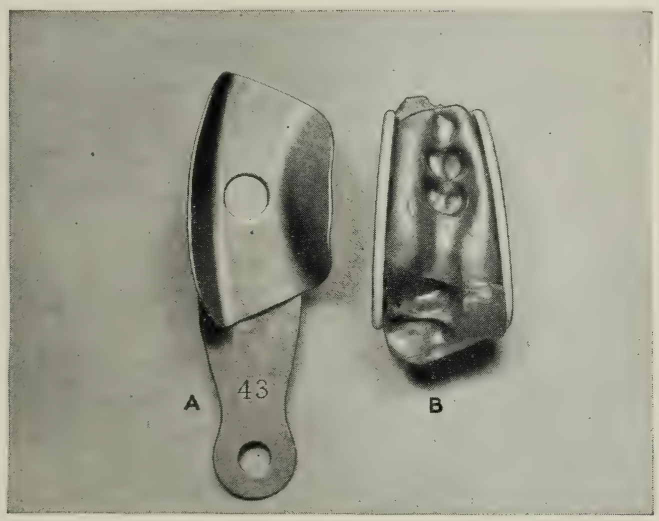


Fig. 113. A. Impression tray which rotates on handle. Suitable for impressions for small bridges, such as the Nesbett, in either the anterior or posterior regions. B. Bite with side supports to prevent spreading of the wax.

The impression is then varnished with separating mediums. A good method is to use two coats of shellac mixed thin enough for the second coat to give it a slight gloss. When this is dried, a coat of sandarac varnish is applied which gives a high gloss. The varnishes have a tendency to fill in any minute bubbles which are on the surface and give a nice gloss to our cast. The sandarac varnish is tested by touching the surface of the varnish with the finger and if it is not sticky, it is dry enough to pour the cast.

Method of Assembling Without Tray.

We attempt of course to remove an impression from the mouth in as few sections as possible, usually four, the palatal, the labial, and the two buccal sections. But at times it is unavoidable that there should be more than four sections. This is especially true where a considerable space may separate two, or more teeth, or where a single tooth is missing at some point. At times, after removal of the impression it will occur that the plaster in such position has broken away from the main section to which it should have adhered, and these pieces must then be carefully teazed out and preserved. It is in cases of this character that the author considers the compound method especially superior to the plaster impression technique. However, with care, good plaster impressions may be obtained even under these adverse circumstances.

Where there are perhaps several small particles of the impression in addition to the main sections, it may be found impossible to assemble the pieces in the tray. Where the assemblage is done without the tray, all broken edges must be thoroughly clean to permit accurate readjustment, and the parts may be held together with sticky wax, flowed over the joints on the reverse, or tray side, of the impression. This sticky wax will be more adherent if used very hot and if the impression has been allowed time to become perfectly dry. It should be remembered, however, that sticky wax is more or less brittle, and each joint should be reinforced by placing a small piece of match stick, crosswise over the joint, and allowing the hot wax to flow into the soft wood. This is always a wise precaution when assembling without a tray, as it is most harrassing to have an impression come apart after it has been once assembled.

Assembling Without Using Wax.

Perhaps the most perfect technique for assembling an impression is that which was recommended by Dr. Norman W. Kingsley many years ago. In this technique, as soon as the impression has been removed from the mouth, the several sections are thoroughly cleansed of all stray particles, by holding them under the running water tap. The tray also is thoroughly cleansed. With the sections clean and quite wet, they are carefully replaced in the tray, and when all are in position, pressure is exerted in such manner as to force all the sections into closer contact. Done promptly and accurately the joints will be practically invisible.

The tray, with assembled sections in proper position, is then set aside until thoroughly dry. Then thin plaster is applied over the joints, outside of the actual impression area, and when this added plaster has set the impression will be firmly luted together. At the same time, lost small particles may be replaced with fresh plaster painted in with a camel's hair brush.

Repairing Impressions.

It may be well to briefly describe this technique. The plaster is not mixed in the usual way. No bowl or cup is used. Just a little plaster is piled on the edge of a saucer, and some water is poured into the deeper part of the saucer, but is not allowed to reach the plaster. With a camel's hair brush, of size suited to the repair to be made, a little plaster is brushed down into the edge of the water, and mixed just thick enough to be carried on the brush. It is then "painted" over the crack, or into the part to be built up, and the brush then at once cleansed by dipping it into water, and the wet brush is then carried over the fresh plaster again, "painting" it into proper form. With practice, one becomes quite skilled in this technique for assembling and restoring impressions.

It is the custom of many men to pour the cast without boxing the impression, but I find it saves a great deal of time to box every impression. This is done by cutting strips of pink or yellow base wax about two inches wide and wrapping them around the impression to form a wall. (Fig. 112). They are sealed to the impression with melted wax and the top edge is cut even so that the base of the cast will be flat.

In the Class I impressions, the boxing should not be made too close, in front, as it does not give enough strength of material, especially if the cast is to be used for a gold plate and swaged against later. One advantage of taking this type of impression, without the labial surfaces of the anterior teeth, is this fact, and if by chance the excess plaster does run over the labial surface of the anterior teeth it should be trimmed away so that we obtain extra strength in the cast.

Technique for Pouring the Cast.

In pouring the cast, the boxed impression should be dipped into water for a few minutes to be sure that it has no dry places which will absorb moisture from the cast and give a soft surface. But we should be certain that any excess of water is shaken from the impression, as this will settle down into the impression of the teeth and form bubbles in the cast. If by any chance the impression is allowed to stand over night, the impression should be soaked for fifteen minutes until it is thoroughly saturated with water.

After having dipped the impression in water and having removed the surplus, we begin pouring our cast material into the boxed impression, starting at one side and gently jarring until it is worked around to the other side, and then gradually filling up until we have filled up the ridges and impressions of the teeth. If any air bubbles form, they can be jarred to the surface by holding the boxed impression in the hand and striking the side of the hand on the bench. Never strike the impression itself on the bench, as it is likely to jar some of the pieces of the impression loose.

Reinforcing Plaster Teeth.

At this stage of pouring the impression, it is a good idea to strengthen the teeth. I have experimented with many things but have found nothing so good as little brass brads about three quarters of an inch long. They do not rust, as the iron nails do, and if teeth need to be removed from the cast in the process of making a gold denture, they can readily be sawed through with a bracket saw. Never use pieces of match stick or tooth pick as they have not enough strength and the dry stick absorbs moisture from the cast, leaving the tooth very frail.

Another method, which is highly recommended by those that have used it, is to utilize ordinary pins. In this technique, the head of the pin is cut off, and the point is driven into the impression of the tooth to be reinforced, prior to pouring the cast. Care should be taken to have the pin placed so that it will be situated in the centre of the tooth after pouring the cast. It is claimed for this method that such reinforced teeth may be readily broken from the cast where this is requisite, as in making metal dies for swaging. The pin usually remains in the main body of the cast, but is easily withdrawn because the head has been cut off. Later, if desirable to replace the tooth on the cast, it may be put back in position, and held in place by driving a new pin through the hole which already exists; and it may be secured firmly by using a pin long enough to be driven a little deeper into the body of the cast. The head of the pin will aid in holding the tooth, and the joint may be luted with plaster on a camel's hair brush, as described for repairing impressions.

Pouring Artificial Stone.

I seldom use anything but artificial stone for making my casts and I find that it is best to work the stone over the surface of the impression and into the impression of the teeth with an instrument similar to the rounded end of the Grittman carving tool, by pushing the material ahead of the instrument. After the surface is covered, a very gentle jarring of the impression helps to eliminate small air bubbles. If you have many casts to pour, the jarring can be done by holding the impression against the piece of board, which in its turn is held on a felt wheel on the lathe, the surface of the felt wheel having been roughened slightly with a knife. When the boxed impression has been filled, a discarded photographic plate may be placed on the surface to give it a smooth bottom. This is important if the cast is to be used to swage a gold plate on. If it is to be used for vulcanite work, it will be a good idea to allow the material to set until it is almost hard and then scrape across this surface with a knife blade, making grooves. These grooves will assist us later when we are mounting the cast on the articulator. If it is accidently jarred loose, it can be returned to its proper position, the grooves acting as key marks. It is only necessary to do this at this time, when the casts are made of artificial stone, as the stone cast would be too hard to cut with a knife if we waited until set. Also, in using artificial stone, we should see that we do not box our impressions too deeply, as it is almost impossible to cut away excess after the stone is thoroughly set. Plaster takes about two or three hours to set, while artificial stone needs from eight to ten hours.

Separating Cast from Impression.

When the cast is thoroughly set, we are ready to separate the impression from the cast. The boxing wax is stripped off, (Fig 114) and any plaster of the impression which has run over to the side of the tray is cut loose, as well as any sticky wax which holds the impression to the tray. The wax which holds the sections of the impression together is loosened and also the wax which runs across the back of the tray is removed. Grooves are cut along the top of the ridge and just back of the anterior teeth, until we begin to see the shellac varnish which has sunk into the plaster. When we see this varnish we know that we are close enough to the cast to break the impression away, without fracturing the cast.

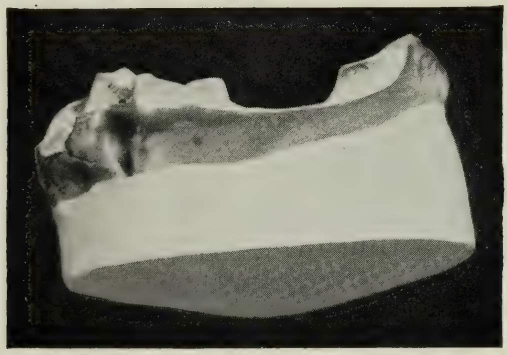


Fig. 114. Cast poured, and boxing removed. Impression cut down to facilitate separation.

It will be remembered that we tried to leave some thickness between the occlusal surface of the teeth and the tray. It will be necessary to cut this down so as to weaken the impression, but as these impressions are all removed from the mouth in sections, it will not be necessary to groove them quite so much, except when we run back of single teeth.

The separating of the cast is a matter of practice. No hard and set rules can be laid down as to the best place to cut. The student must use judgment and learn by experience. The main thing is not to break the teeth and what is more important, not to put knife marks in the cast as these will be raised on the finished plate, causing the patient a good deal of disturbance.

Separable Impression Trays

There are a number of types of plaster impression trays upon the market, which are divided into separable parts to facilitate the sectioning of the plaster, and some of these work very well when the teeth are quite regular in the arch. The Balter tray is shown in Fig. 115. Care should be taken in the selection of the tray so that the separating lines occur in the right places. Care should also be taken in pushing the impression to place in the mouth so that the separating lines of the tray correspond to the direction of the crest of the ridge. (Fig. 116.) The writer's experience with these trays has been limited to one manufactured by Balter of New York and a small one for crown and bridge work by Kidder. (Fig. 117.) Impressions for crown and bridgework can also be made with the Balter tray by using one side of the tray only.

The separate pieces of the tray are held together by small lock nuts which are removed when the plaster begins to harden, and, to obtain the nicest results careful timing of the plaster must be made, because if it is allowed to harden too much there will be some difficulty in removing it from the mouth.

In reassembling, care must be taken to see that no small broken pieces of the plaster lie between the metal sections of the tray.

After they have been assembled, they are handled in the same manner as other plaster impressions, that is, varnishing, boxing and pouring.

The Balter tray can be used very nicely in taking combination of modelling compound and plaster impressions, as will be described later, under the heading of Roach's technique.

Combination Impression Methods

There are several methods of taking impressions, other than those mentioned previously, which have more or less value. Those which are the most useful are the combinations with compound, that is, compound and wax, and compound and plaster. Also combinations with wax and plaster and then wax alone.

Dr. Greene, in outlining his technique for use of modelling compound in full denture construction, devised a method called "the student's method" of making a tray of compound and in this tray placing a thin

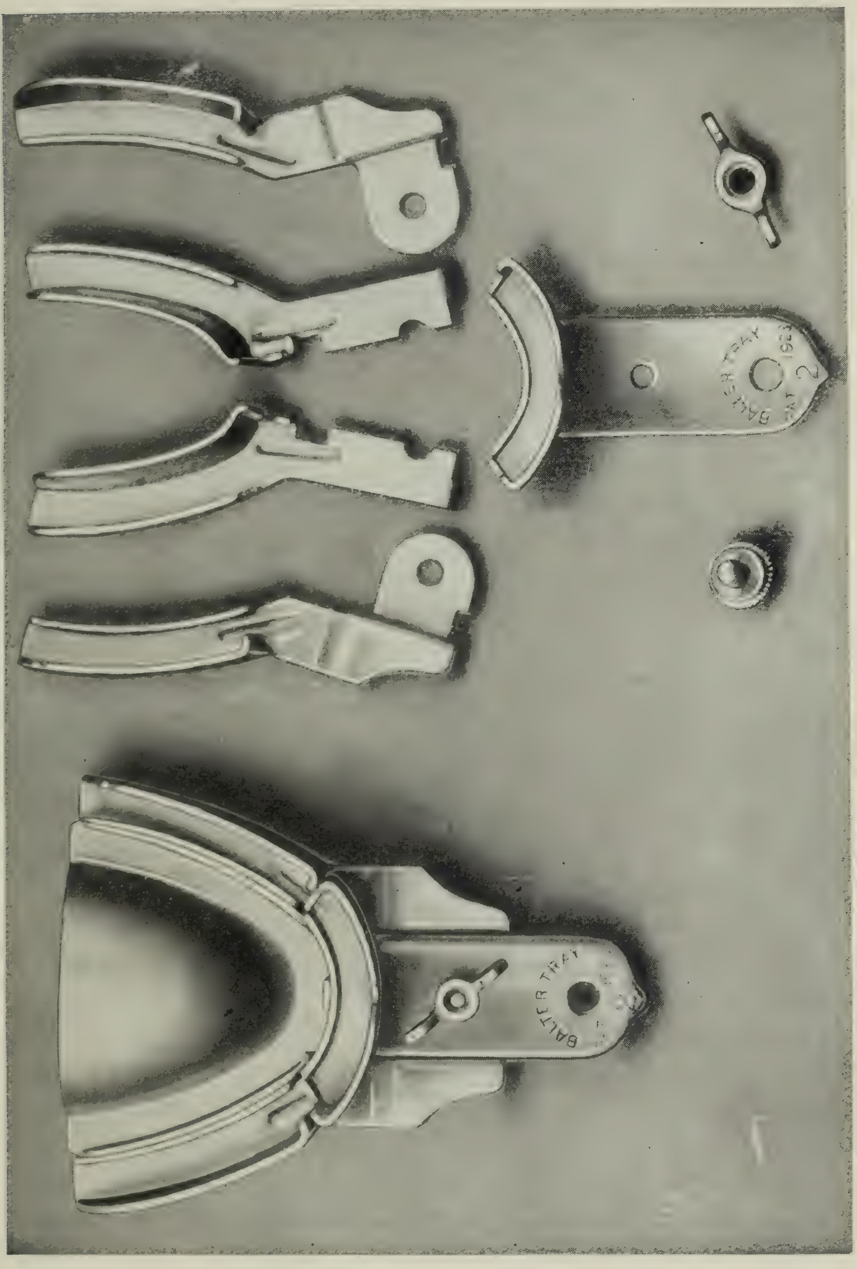


Fig. 115. Balter impression tray, left closed, right opened.

coating of plaster of creamy consistency and completing the impression. This method was used mainly by Dr. Hall and Dr. Patterson.

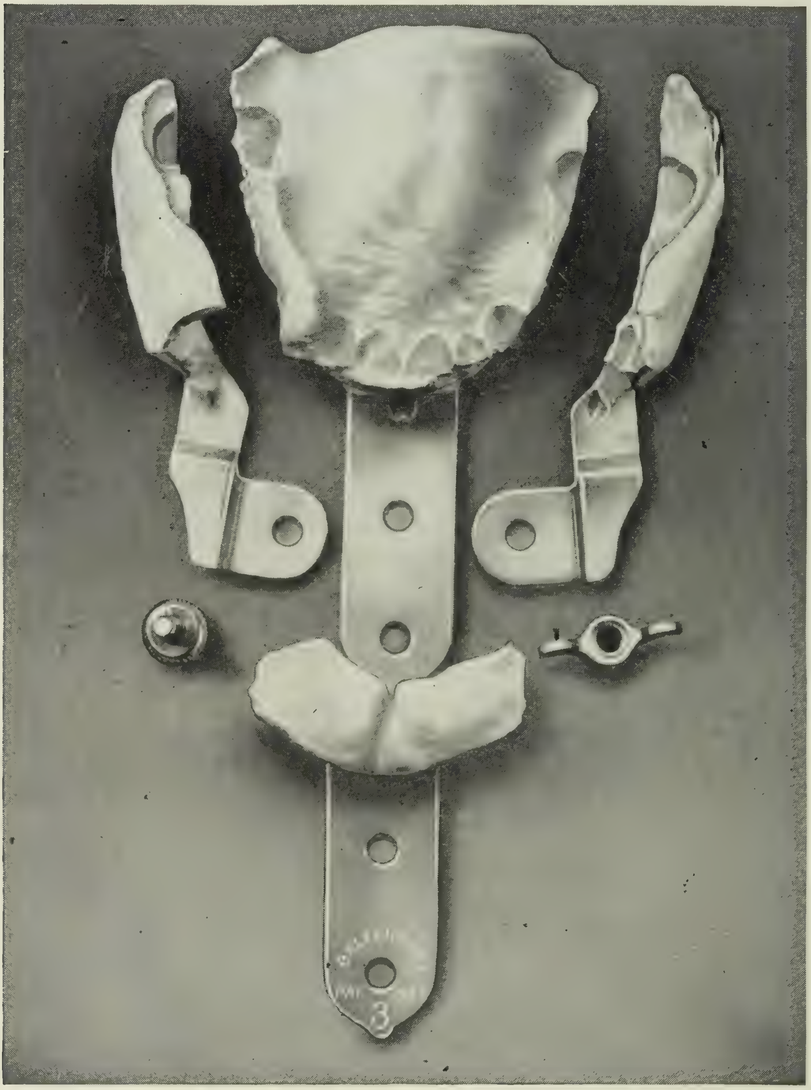


Fig. 116. Balter impression tray with impression separated.

The writer has always thought that this method is a short cut to eliminate the necessary steps in taking a compound impression. Other men tried to apply this same method to taking partial impressions but it always seemed to me to be the height of folly, as there is not sufficient thickness of plaster, if it fractures, to allow it to be replaced accurately. It can however be used with some success in Class I, upper and lower impressions.

A method which I think was devised by Dr. Roach, can be used with some success, and in a student's hands might be worked more easily than the sectional modelling compound impression in the Class II and Class III types.

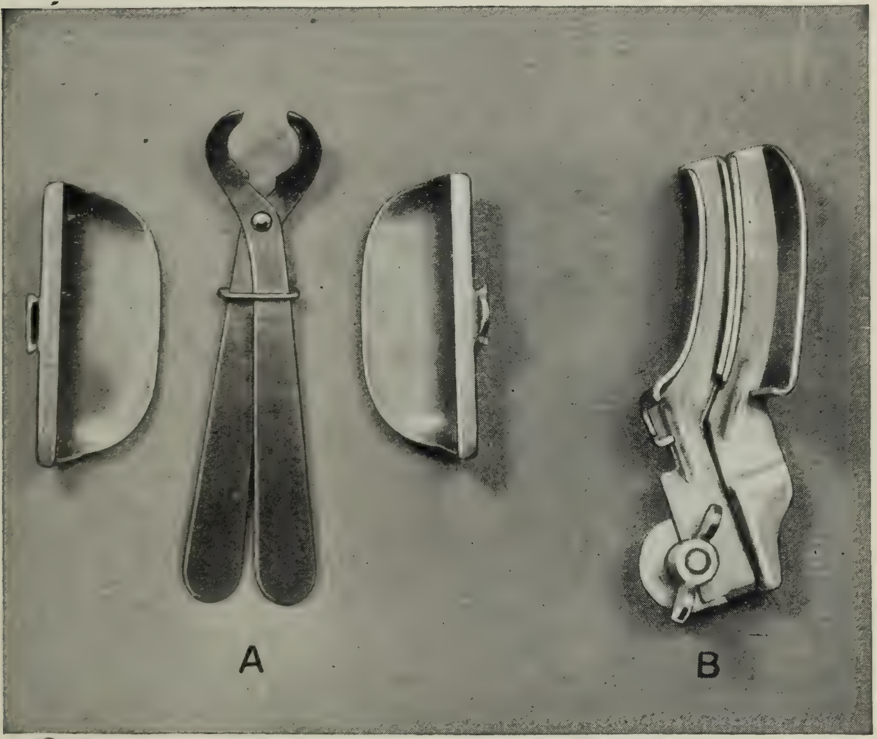


Fig. 117. A—Kidder bridge impression tray on left. B—Half of Balter tray on right used for bridge impressions.

But the outstanding method if a substitute is wanted for the sectional compound impression, is the compound and wax method.

The full wax impression methods are mentioned only in passing, as the writer thinks that they are slipshod and that the student should not be encouraged in their use.

Wax is not a substitute for compound, and wax and plaster have many disadvantages over compound and plaster, or plaster alone.

Roach Impression Method.

A tray is selected and fitted to the study model in the manner described for taking the first section of a compound impression. The compound is heated and pressed into place. After it is sufficiently chilled it is drawn from the mouth by removing it about a thirty-second of an inch and then pushing it back to place, this being repeated until it finally releases itself and goes to place without binding. It is cut with a sharp knife in exactly the same manner as described for a sectional modelling compound impression, that is, along the occlusal-buccal edge of the posterior teeth, the incisal edges of the anterior teeth, and across the crest of the ridges between the teeth.

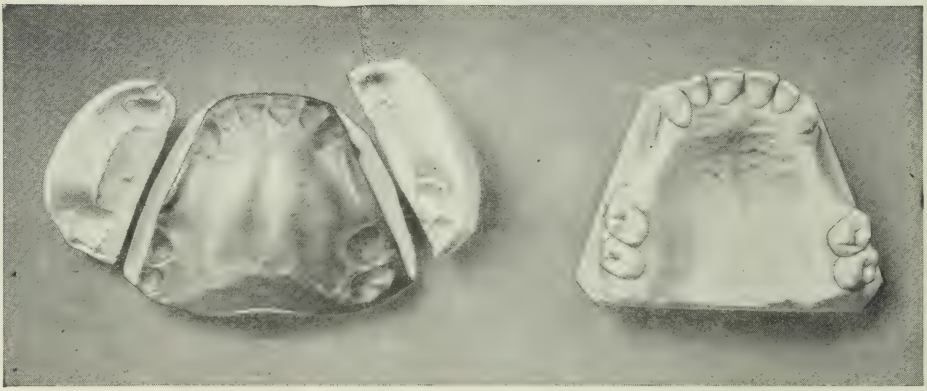


Fig. 118. Combination compound and plaster impression. Note edge of tray extending beyond edge of impression to make a shelf to support the plaster.

When this is done so that the impression releases itself and goes to place without binding, any extension saddle areas are muscle trimmed and the posterior border of the impression is built up to post-dam it. This post-damming can be done with black wax instead of compound. The buccal and labial sections of the impression are taken in plaster instead of compound, or better still Complastica, or Solvite (plaster which dissolves in hot water).

When cutting the tray, that portion which is over the occlusal surface of the teeth should not be cut as narrow as you would for an ordinary compound impression and this extra piece of metal, as shown in Fig. 118 will act as a shelf upon which to build the plaster.

The plaster is mixed and when the first section of the impression is put into place and held by the assistant or the patient, the dentist holds back the lips and cheeks, and, with a spatula, places the soft plaster upon the buccal and labial surfaces. The extension of the tray aids in retaining the plaster. The lips are allowed to come over the plaster and the dentist then takes hold of the first portion of the impression and sees that it is properly seated.

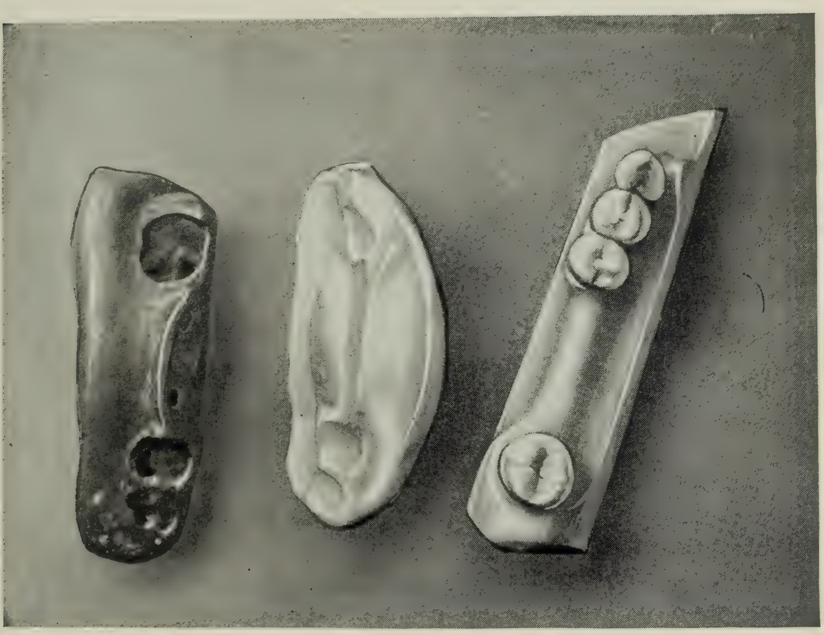


Fig. 119. Impression by Roach method when only one side of the mouth is taken, as for Bonwill type of case.

When the plaster has hardened, vertical cuts are made over the cuspid teeth, parallel with their long axes, the plaster is removed in sections, the first portion of the impression is taken from the mouth and the pieces of plaster placed back upon it to see if it is complete.

The advantage of using Solvite, or Complastica, is the fact that when we heat the impression to remove the compound, the plaster comes away without the necessity of chipping it off.

If ordinary plaster is used, then it will require to be varnished and treated the same as any other plaster impression. The pieces of plaster are waxed in place, the plaster varnished with shellac and sandarac, or any other good separating medium, boxed and poured in the usual manner, and then separated.

This method is not as cleanly nor as acceptable to the patient as the full compound method, but in the hands of the student the full compound method is a little more difficult when obtaining impressions of the buccal or labial areas.

This is not true, however, where the pieces are separate, but it is rather difficult for the student to try to obtain the buccal or the labial surfaces unassisted, when there are three sections coming together. This method applies very well to the taking of impressions for the Bonwill type of case. The lingual side is taken in compound and the buccal in plaster. In taking the lingual portion, the entire saddle area is included in the compound, even that portion which extends over on the buccal side of the ridge; then the buccal portion is taken in plaster. (Fig. 119.) After the modelling compound has been properly trimmed it is replaced in the mouth and the plaster is applied to the buccal region.

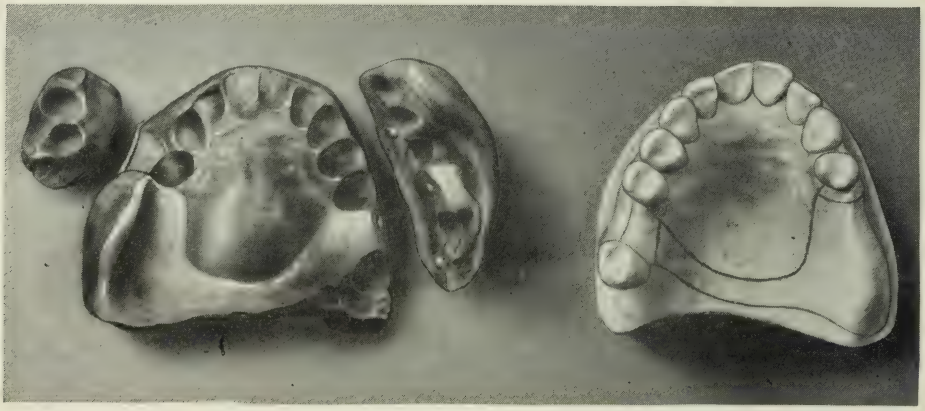


Fig. 120. Compound and wax impression. Palatal bar to be constructed; hence only that portion of impression covered by saddle and bar is covered with wax.

This type of impression is difficult to take in compound because the student has a tendency to push the lingual portion of the impression out of position when he is taking the buccal side.

The author does not use this method in his own practice nor with his students, as he believes that it is a simple matter to develop skill enough to use the full compound method, and the mussiness of the plaster and the dislike of the patient to the same, makes the use of it disadvantageous.

Compound and Wax Impressions. Men who do not develop sufficient skill in full compound technique are sometimes successful with the compound and wax method.

A tray is selected and cut in a similar manner as for other compound impressions, and the impression is taken as accurately as possible. The first section of the impression is cut along the lines previously described. If it is a Class I impression, the little side pieces are taken and laid aside. If it is a modification of Class I, or any other type of impression, the buccal and labial pieces are made and laid aside. Then the first portion of the impression is coated with a thin coating of wax.

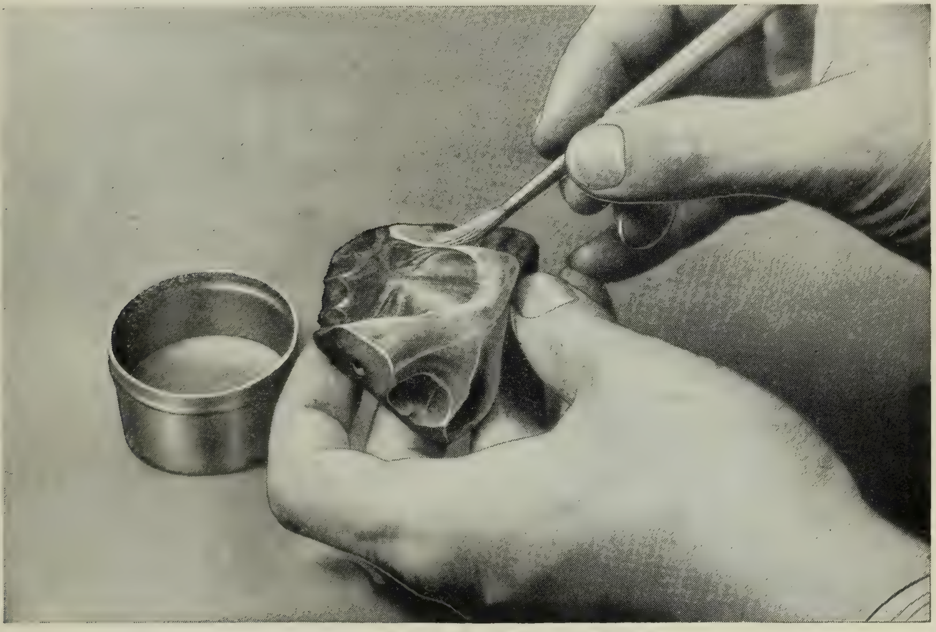
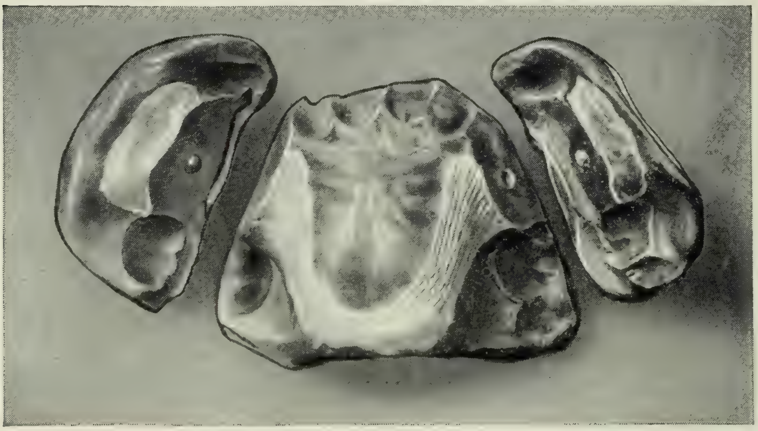


Fig. 121. Painting wax on compound, over area to be covered by saddles. Melted wax in can.

This coating of wax should cover only those areas of the impression which are to be covered by the saddles, or the bars. (Fig. 120.) This method was devised by the author for men who do not develop sufficient skill to rebase with compound wafers. The writer advises the use of the Tompkin's or the Everett soft wax, or carding wax. This wax can be melted and painted with a brush on the surface of the impression. The soft wax will fill in any inaccuracies of the compound, and at the same time give saddle compression.

After the compound with the wax painted upon it (Fig. 121) is placed in the mouth and considerable pressure brought to bear upon it, it is held steady about a minute to allow the wax to crawl, and upon lifting it out if we find brush lines still remaining upon its surface we will know that this portion of the wax has not come in contact with the tissue. (Fig. 122.) Care must be used not to get distortion if it runs into the



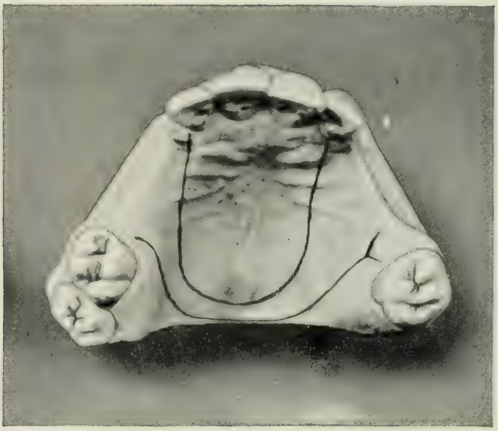


Fig. 122. Impression of Class III, modification I. Wax painted on bar and saddle area. Note brush marks on wax, indicating deficiency of wax.

undercuts. The writer believes that the first method described in this book is the most accurate, once the technique is mastered, and this method just described, of wax and compound, is therefore only a substitute, providing a short cut.

It can however be used with some success in Class I, lower, cases where there are very thin ridges and where the application of a wafer of compound in rebasing would be difficult. It can also be used successfully in palatal bar cases, but the wax is painted only over the portion of the impression where the bar and saddle are to rest.

After the wax has been painted on and heated, the first portion of the impression is placed in the mouth and any surplus which escapes around the sides of the impression is removed. The buccal pieces (see Fig. 121) are coated with wax in a similar manner, but only upon the surface where the saddle will rest, not upon the tooth surface, and put in place against the first portion of the impression; and it is best in these cases to heat the wax slightly along the edges, with a mouth blowpipe, so that there will be a gradual gradation of thickness of the wax, from the edge to the center.

While the first portion of the impression is held firmly, the impression is removed from the mouth and pieced together, and if care is taken, you will have an impression which is far superior to the plaster-wash method. No false move should be made in piecing the impression together, because if when putting the buccal pieces upon the first portion of the impression we should allow it to slip, as it often does, we would destroy the joint of the wax and inaccuracy would result at this point, which would be impossible to correct unless placed back in the mouth. The assembled impression is boxed and the cast is poured.

Plaster-Wash Impression Method.

Some men believe that the impression of the tissues of the mouth should be taken when at rest and not under compression. The writer and those of the compound cult entirely disagree with this view, but no text book would be complete without a description of the plaster-wash method.

As mentioned before, the plaster-wash method may have some advantages where there is a mass of flabby tissue in the mouth which should really be excised except that the patient refuses to have it done; or in those cases where there are pads of soft tissue on each side of the median line, which, when compressed too tightly, swell and force the denture out of position.

In partial cases however the writer believes that it is impracticable to use plaster-wash except in a Class I type of case, or in a Class I, modification, type of case, and then only when the remaining teeth are short without much bell shaped contour.

An impression tray is selected and filled with compound. An impression is then taken, but the tray is moved about to enlarge it so that there will be a little space between the teeth and the compound. When the impression has sufficiently hardened, it is lifted from the mouth and trimmed along the lines advised for a Class I, sectional compound impression. Care should be taken to cut back far enough so that there will be sufficient thickness of plaster around the teeth, even scraping the impressions of the teeth to gain thickness at this point if it is necessary. The entire surface of the compound which is to be covered by plaster should be scarified, to allow the plaster to adhere more readily. (Fig. 123.) It is not advisable however to scarify those edges of the saddles that have been muscle trimmed, or post-dammed. The compound acts simply as an impression tray and this is filled with plaster of a creamy consistency, with some accelerator added to cause it to harden.

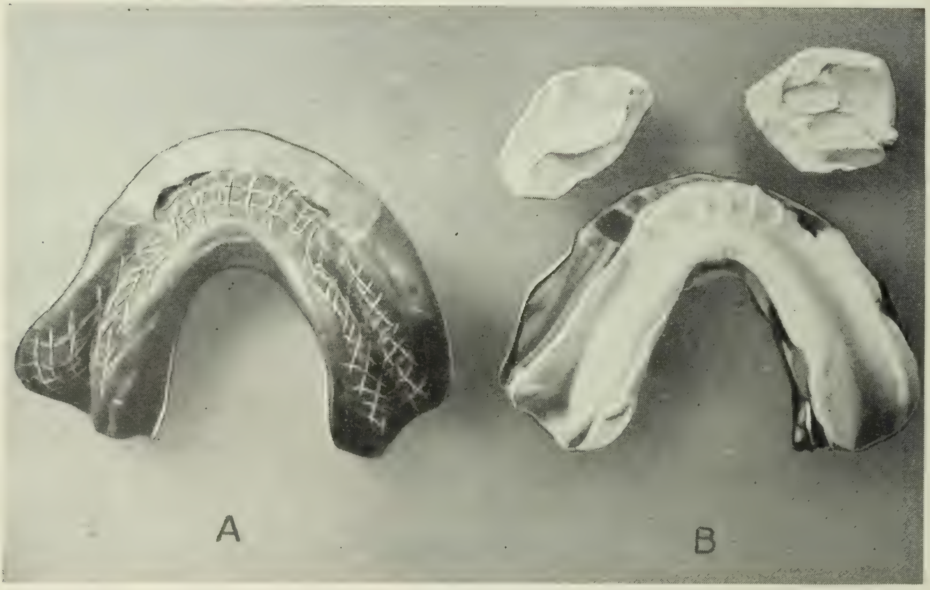


Fig. 123. A. Compound impression prepared for plaster-wash.
B. Compound impression; plaster-wash finished.

After the impression is placed in the mouth a small quantity of plaster is spread upon the buccal surfaces of the bicuspid, or the cuspid teeth and the lips manipulated over these.

If it is a Class I, modification I case, plaster should be placed upon the whole labial and buccal surfaces of the teeth. When the plaster has sufficiently hardened, that which is upon the labial or buccal surfaces is removed by grooving it with a sharp knife and breaking it into sections. (Fig. 124.)

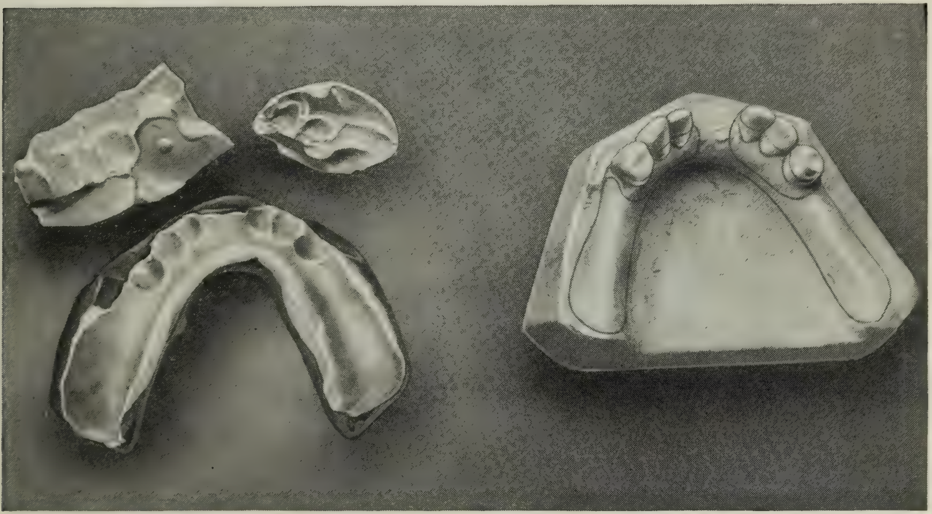


Fig. 124. Impression of Class I, modification I, plaster-wash impression.

The first portion of the impression is then carefully lifted from the mouth and the pieces are put together and sealed. The writer finds that if there is any great degree of undercuts around the teeth there is a tendency for the plaster to break away from the modelling compound which forms the impression tray, and as these pieces are necessarily thin they are difficult to arrange into place.

Some men use this same procedure, substituting yellow beeswax for the modelling compound, which is easier to cut to allow for the thickness of the plaster. Also the wax bends when the impression tray is removed from the mouth, and allows the plaster to fracture; but as a rule it does not come away from the beeswax. These pieces are forced back to place by bending the underlying wax. I believe, however, that this is an inaccurate method, and should not be used except in an emergency when no other material is at hand except beeswax.

These plaster-wash impressions should be treated the same as a full plaster impression when piecing them together, varnishing and pouring casts. If Solvite, or Complastica is used to wash the impression it is much easier to separate, and will come away when we heat the compound.

Some men make study models from impressions in wax, either pink paraffin or beeswax, but I find that compound is very much easier to handle and gives a much more accurate result. However I do have use for the bite impression made from pink paraffin wax in those cases where we are supplying the Bonwill, or other forms of bridgework, because we do not pour the materials directly into these bite impressions but use them only to register relationship of casts previously made from compound impressions.

CHAPTER VII

Bite Impressions and Cast Materials

A consideration of the subject of impressions would be incomplete if something were not said about squash plaster bites, which are really a combination of bite and impression. The same would hold true of impression bites made of wax. Hence both will be described.

Plaster Squash Bite Method.

The plaster squash bite method was formerly used for taking the impression and the bite at the same time. It is of little use in platework except for the Bonwill type of denture.

The dentist placed plaster around the teeth in both the upper and the lower arches by means of a spatula, and directed the patient to close the mouth. If he was attempting to get the relationship between bridge abutments, these were put into place before the plaster was introduced. After the plaster had thoroughly hardened, the mouth was opened, and generally, the impression broke into two pieces, one for the buccal and one for the lingual side. (Fig. 125 A.) These were pieced together, fastened with wax, varnished, and the casts poured. Coincidentally with pouring them they were placed in a bridge articulator. (Fig. 125 B.) When sufficiently hardened they were separated, and the relationship between the upper and lower casts was established, without making a second step. There were inaccuracies, however, and this method has been superseded by the bite impression method.

Bite Impression Method.

This bite impression method in wax was originally used by pouring plaster directly into the wax impression and articulating it on a small bridge articulator at the same time as it was poured, but as the wax impression is not accurate the dentist finally used it only as a means of articulating casts which have been made from impressions taken in either plaster or in compound.

These bite impressions are best made in the following manner. The student should provide himself with side plates. Supplee of New York makes them of aluminum; Condit of Boston makes them of paper. Or these side pieces may be made of air chamber metal, or of Ash & Sons tray metal, cut to the proper shape, holes punched in them and laced with dental floss. (Fig. 126.) The lacings should be so regulated as to allow the plates to lie parallel to one another, and about a half inch apart.

Two rolls of pink paraffin wax, about a half inch wide, a half inch thick, and an inch and a half long, are heated sufficiently to soften them throughout. One of them is placed between the two side plates below the lacing. A strip of gauze is cut and placed between the plates over the lacings to cover this wax. A second piece of wax is placed upon this between the plates and we are ready to take our impression and bite.

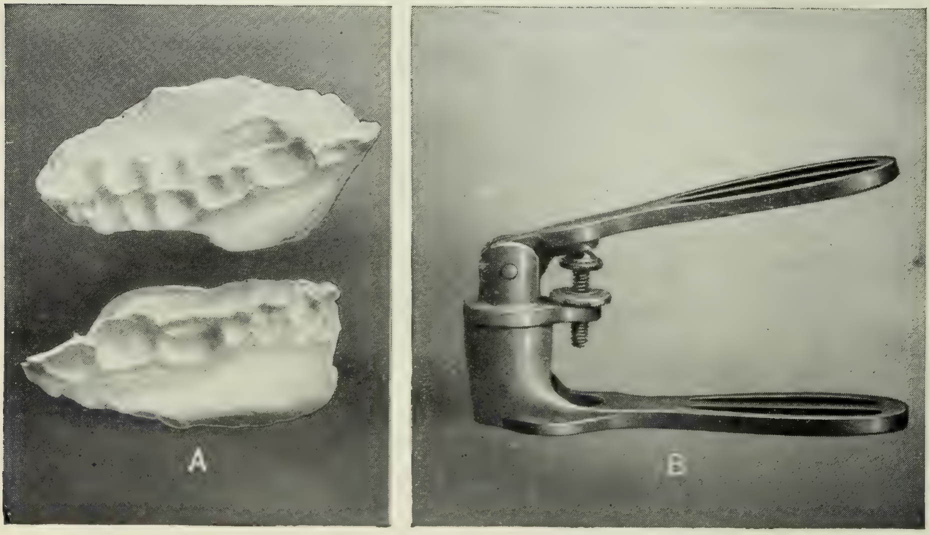


Fig. 125. A. Squash plaster bite impression. B. Articulator used in articulating casts after they are poured into this impression.

The softened wax is placed in the patient's mouth forcing it down upon the lower teeth with the fingers; then ask the patient to close the mouth until the teeth on the opposite side come together. The ends of the dental floss are pulled upon, and this draws the lingual plate against the wax, forcing the wax against the lingual sides of the teeth. The buccal plate is pushed in with the fingers and the dental floss is tied. Then the wax is chilled. At no time during the compression of the wax, should the patient open the mouth. After the wax has thoroughly cooled, the patient is requested to open the mouth and the wax will separate from either the upper, or the lower teeth.

Further chilling should be done with cold water and the impression is lifted from the teeth. Upon examination it will be found that the gauze prevents the thin film of wax between the teeth from being distorted. Some men substitute thick tin foil (No. 60 gauge) for the gauze.

The fact that this thin film of wax remains intact, makes this method superior to the plaster squash bite method, by which, if the patient does bring the teeth together, the film of plaster often is so thin that it is lost, and inaccuracies result on the occlusal surfaces. This wax method of taking the bite is so superior to the old method of using a roll of wax to obtain the relationship between two casts, that it should be used universally, where the cast represents only one side of the mouth.

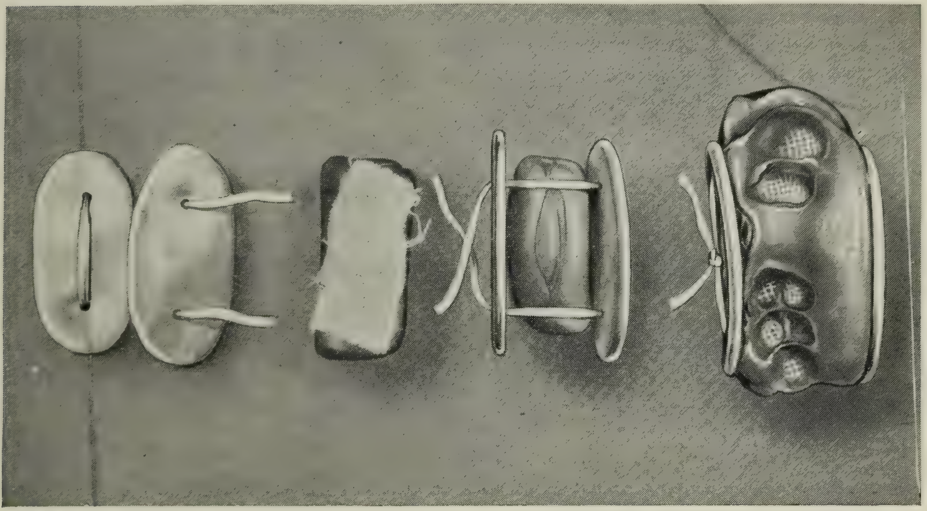


Fig. 126. A. Side pieces. B. Laced with dental floss. C. First piece of wax in place with gauze. D. Impression taken (note gauze between the occlusal surfaces).

Materials Used in Making Casts

Plaster is probably used more than any other material for making casts, but it has certain disadvantages.

One of these disadvantages is the weakness of the material. Casts are easily broken, especially in partial cases; teeth are readily broken off unless strengtheners are placed in them.

Another disadvantage is its contraction after setting. The cast becomes distorted and is not an accurate representation of the arches.

Lastly, it does not hold up well in the vulcanizer, but changes its shape if too much pressure is put upon the flask.

Several methods have been tried to overcome these disadvantages. One was by incorporating hardening materials in the plaster. The best of these was a plaster manufactured by French & Co. of Philadelphia on special order, which consisted of mixing uncalcined rock, finely ground, with a calcined rock. This was used only for casts and it made a very slow setting plaster, but a very hard plaster. Another method was to harden the plaster by the use of alum and other chemicals. If the student cares to experiment with these methods, formulas can be found in Prinz's Dental Formulary.

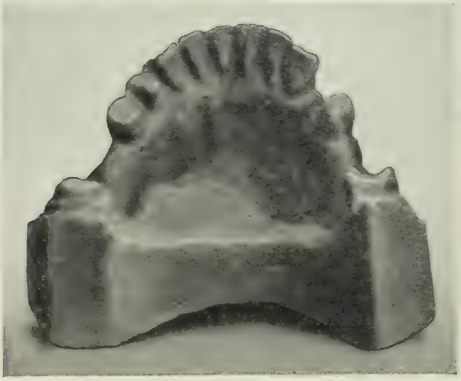


Fig. 127. Cast made of iron and sulphur compounds.

Another material is known as Spence plaster which is probably a combination of Portland cement, plaster and sand, used with an accelerator to hasten the setting. This is used a great deal today by some men, and I believe it stands up in the vulcanizer about as well as any other material. I have no data upon its expansion and contraction.

Artificial Stone. The artificial stones are rapidly supplanting plaster for the making of casts. The basis of most of these is ordinary high grade cast plaster, combined with barium cements, in such proportions as to balance the expansion and contraction.

They are also made from plaster combined with what is known in the dental trade as "Keen's cement." These stones are both white and gray. The gray stones are probably mixtures of barium cement and plaster, and give sharper lines than those made from the Keen's cement, as they contain alum and have a tendency to form into globules. Most of the white stones have a basis of Keen's cement. Of course this is a moot question, as the manufacturers will not give out their formulas.

If there is any doubt as to the stone which you are using, tests can be made by pouring a mix in thin glass tubes, or beakers, and placing a wooded screw upright in the center. If the material expands it will crack the glass. If it contracts it can be drawn out of the beaker by pulling upon the screw. In either event communication with the manufacturer will correct the fault. If the expansion, or contraction, does not produce either of these results, the material is sufficiently accurately balanced to use it for our casts.

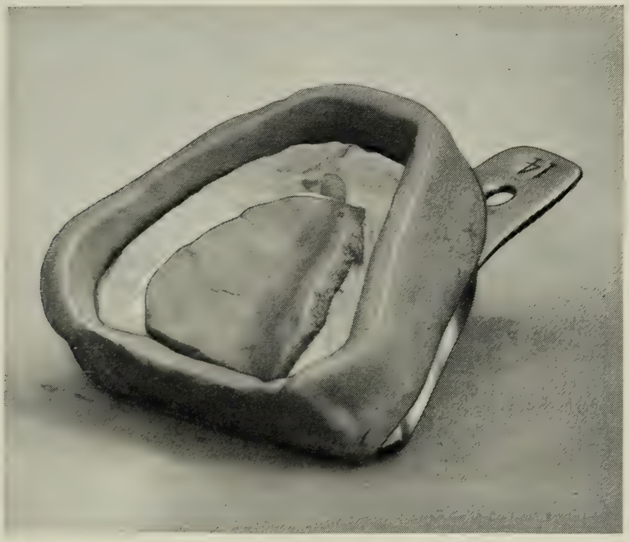


Fig. 128. Plaster impression boxed with moldine for pouring iron and sulphur compounds and fusible metal.

Iron and Sulphur Compounds.

Casts can be made of iron and sulphur compounds, but they are useful only where we are constructing gold work, as they will not go through the vulcanizer.

Those who use these materials claim they get much sharper casts and much more accurate ones, as it is not necessary to varnish the plaster impression, using only a thin coating of oil. (Fig. 127.)

These preparations come in the form of powder and lumps, and can be purchased at the dental supply houses, together with a ladle for melting them. These ladles are made of iron and have a bell shaped bottom to confine the flame of the Bunsen burner over which the materials are melted. If the material comes into contact with the open flame it will ignite and make a great odor in the laboratory. The combination is not explosive but its fumes are suffocating. It should be heated very carefully and should be constantly stirred to allow any bubbles of gas to escape; otherwise, the cast will be porous.

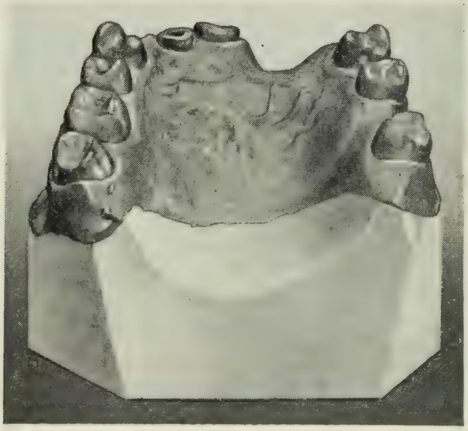


Fig. 129. Fusible metal cast (Dee metal). Plaster base to make the models flat when swaging upon them.

The impression should better be of plaster, although it is possible to pour these materials into modelling compound impressions, if they are not overheated, and if the ladle is held high enough and poured in a thin stream to allow cooling before reaching the impression compound.

The compound impression should be chilled in ice water and thoroughly dried with air from the compressed air blower, so that no bubbles will form when the iron and sulphur compound is poured into the impression.

In pouring it in plaster impressions, the impression should be pieced together by the plaster method rather than by using wax, because the wax may melt and spoil the cast.

The impression should be dry when the cast is poured and can be dried in the oven, or over a steam radiator. It need not be hot but must have all the excess moisture removed when we pour the sulphur compound into it, or it will form bubbles and spoil the cast.

If we desire a heavy base it can be made by boxing the impression with moldine or "plasterline." (Fig. 128.) When pouring the compound it should have the consistency of thick molasses, which should be poured starting at one corner of the impression and allowing it to run around to the opposite side, pouring it slowly enough to prevent air from being confined in the impressions of the teeth, or bubbles will result. When it has hardened the boxing is stripped off, and the impression is separated from the cast. This gives an extremely hard cast, but I do not think that it is comparable to artificial stone.

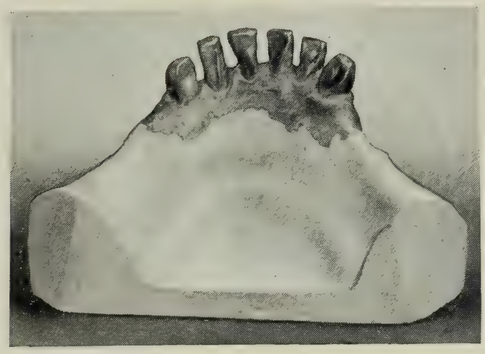


Fig. 130. Cast where the teeth are poured in fusible metal, and the remainder poured in stone.

Fusible Metal Casts.

Casts may be made of fusible metal. (Fig. 129.) The writer's experience has been limited to the Dee metal. This is a low fusing metal, probably containing bismuth or antimony, and when poured into a plaster impression gives a very sharp outline. It must be poured into a plaster impression, not held together by wax, but by plaster. The impression must be dried to get rid of any surplus moisture, but it need not be hot when the metal is poured into it. The metal is melted in an iron ladle which is kept exclusively for that purpose. Do not use the one with which the sulphur compounds are poured as it will spoil the metal. The same precaution should be observed in pouring, that is, start at one side and let the metal flow to the other side, gently jarring the impression to be sure that it is down in all the impressions of the teeth. When it has hardened the impression can be separated from it. This material likewise cannot be used in the vulcanizer.

In many instances it is not necessary to pour the entire cast in fusible metal; pour the teeth only. When it has hardened (Fig. 130), the rest of the impression can be poured in plaster; or, if you have a small piece, such as a Bonwill bridge, you can pour the teeth and the saddle area in fusible metal, strengthening it with plaster. (Fig 131.)

For small pieces such as Bonwill bridgework the teeth on the casts can be made by packing the impressions of them with amalgam. The best method of making casts with amalgam teeth, where cast clasps are to be made, was originated by Dr. Nesbett.

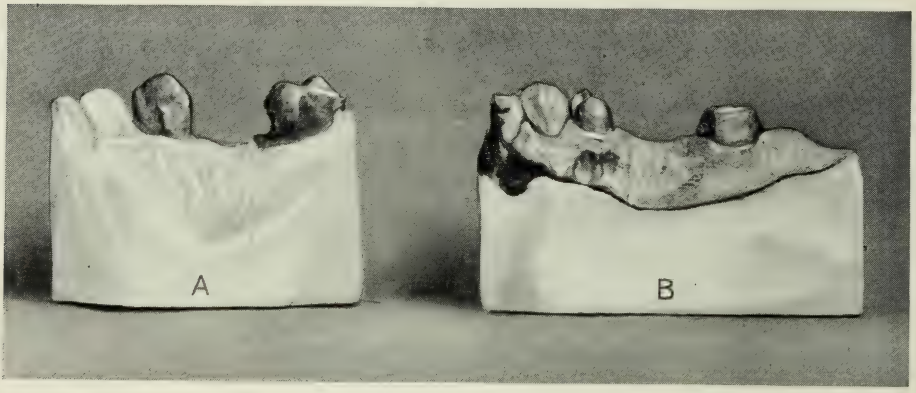


Fig. 131. A. Small cast as for Bonwill bridgework; teeth poured in Dee metal and remainder poured in artificial stone. B. Where the teeth and saddle portion are poured in fusible metal and the remainder poured in stone.

The following is a quotation from his article in the March, 1918 *Journal of the Allied Dental Societies* and the illustrations are from *Dental Items of Interest,* September, 1923.

Dr. Nesbett's Method.

"The plaster impression should be put together as soon as fairly dry, using the tray for a matrix or guide for the proper position of the pieces. Personally, I find it almost impossible to get the pieces in their proper places without some slight distortion, unless I place them in the tray, and secure them with sticky wax. The impression should be coated lightly with shellac, followed, after it is dry, by sandarac varnish, being careful not to use either coating too thick. When the last coat of sandarac is thoroughly dry, the impression of the two teeth that are to be clasped are packed with amalgam, small tapered metal dowels, rectangular in cross section, being sunk in the amalgam before it has begun to set. Care should be taken to shape and smooth these dowels so that they will draw easily, and to set them as nearly parallel as possible, so that both teeth, no matter how badly tipped, can be removed in the same plane. (Fig. 132.)

"After the amalgam has set hard enough, so that the dowels are firm, they are *oiled* and the balance of the impression packed with Weinstein's artificial stone. Plaster can be used for this part, but the artificial stone gives a more satisfactory working surface. This new material, a calcium barium-silicate, is an almost invaluable material for the crown and bridgeworker. Casts made from it are remarkably hard and durable, and it possesses practically no expansion nor contraction.

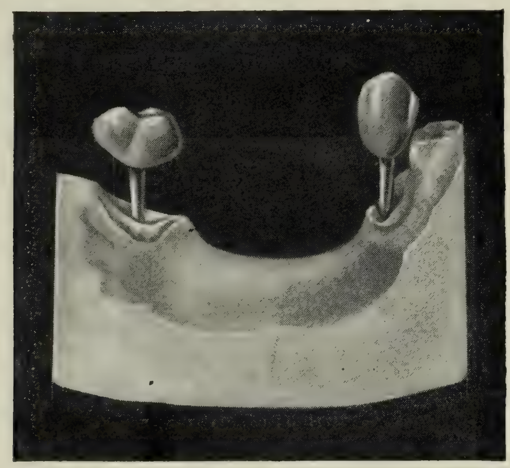


Fig. 132. Cast for Nesbett bridgework. Casts made in artificial stone. The amalgam teeth have partly been drawn from the model showing the dowels.

"The compound impression is next poured and the two resulting casts are mounted on an anatomical crown and bridge articulator, the wax guide bite being used to establish occlusal relations."

Shaping the Cast.

After the casts have been separated from the impression the student will find that it is rather difficult to cut the artificial stone base unless he has given some attention to the manner in which he has boxed it. A cast intended for gold work from which a die is to be made should have a flaring base, (Fig. 133 A) that is, it should be wider at the bottom than where it meets the cast. This will permit the full cast to be drawn from the sand when molding for the die.

As I mentioned before, if the artificial stone is allowed to set hard, it is almost impossible to cut it, except with a hacksaw, or a horseshoer's rasp, and even then there is danger of breaking some of the teeth from the cast if we should let the saw, or the rasp slip. A great deal of this cutting can be obviated, if, when we make the boxing, we flare it outward and see that the bottom of the box is parallel to the occlusal plane of the teeth, and when pouring the material in the box it should be filled sufficiently to allow us to place a glass plate upon it, surplus material escaping from the sides of the box. It will then have a smooth base and sides without the necessity of further cutting.

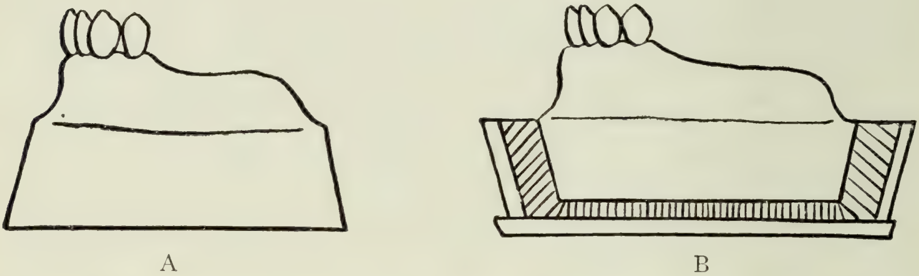


Fig. 133. A. Correct shaping of base of cast on which we intend to swage a gold plate. B. Correct shaping of base of a cast on which we intend to vulcanize. Cross hatching shows directions of lines of force which resist the pressure when closing the flask.

This is not true of casts upon which plates are to be vulcanized; in fact, it is quite the reverse. The base should not flare outward, but inward, so as to facilitate placing in the flask. If we look at Fig. 133 B we will see that the sides of the flask slant inward and it is obvious that if shaped as in Fig. 133 A, it would be difficult to place the cast in the flask and move it around to get it in a correct position, without cutting the sides, which might cause us to displace the waxed up teeth; and for the second reason, that when pressing the rubber, if the lid of the flask should yield, the cast is liable to be pushed out of the flask unless the sides of the base are parallel to the sides of the flask.

The cross hatching in the illustration, (Fig 133 B) which represents the plaster in the flask, also shows the direction of force when we are pressing the flask together, making a unit of the plaster in the flask and the cast.

When boxing an impression for a cast for vulcanite work, the upper edge of the wax should be parallel to the line of occlusion. It is not necessary to have the base flat, or polished. It is better immediately upon separating to cut grooves in the base, so that when we place it upon the articulator, if for any reason it should become detached, these grooves would be key marks, allowing us to put it back in its correct position without obtaining a new bite.

CHAPTER VIII

Use of Facebow and Bite Taking

In mounting casts on an articulator, there are two relationships which are of the utmost importance. They are the relationship of the casts to the articulator, and that of the casts, one with the other.

To obtain the relationship of the casts to the articulator, we use the facebow, with its several forms of attachments. To obtain the relationship of the casts, each with the other, we use bite plates, or bite impressions, such as described in the last chapter.

The facebow is an instrument designed by Dr. Grittman to obtain tracings, but Dr. Snow saw its value in mounting casts upon the articulator and he altered the instrument to make it more easily used.

The facebow is really a large pair of calipers with a movable pointer on each end. These pointers have little rings around them at equal distances apart, so that they can be set to measure the distance between the condyles. It also has a small vise to carry the stem, which is inserted in the bite plates, or the bite impressions. The vise is movable and can be locked in the position it assumes when we make the facebow measurements. (Fig. 134.) Before describing the use of this instrument I should explain the theory of occlusion and the articulating frame.

The Articulating Frame.

The articulating frame, or articulator, is supposed to represent the human jaw, and the casts represent the maxillary and mandibular ridges and the teeth. If these casts are not mounted on the articulator so that they bear the same relationship to the condyles of the articulator, that the ridges and the teeth bear to the condyles in the patient's head, when the artificial teeth are set up on the casts they will not move over each other on the same plane as they do in the patient's mouth.

This plane has been given many names; "plane of occlusion;" "curve of occlusion;" "compensating curve," and "curve of Spee." It has caused a great deal of discussion in the last few years in prosthetic circles. Spee was the first to describe it as a curved plane, which touches the incisal edges of the anterior teeth and the cusps of the posterior teeth, passing through the condyles, or on a plane concentric with the condyles. (Fig. 135.) The description necessitated a separate plane for the upper and the lower teeth, provided the incisal edges of the anterior teeth and the tops of the cusps of the posterior teeth touched these planes.

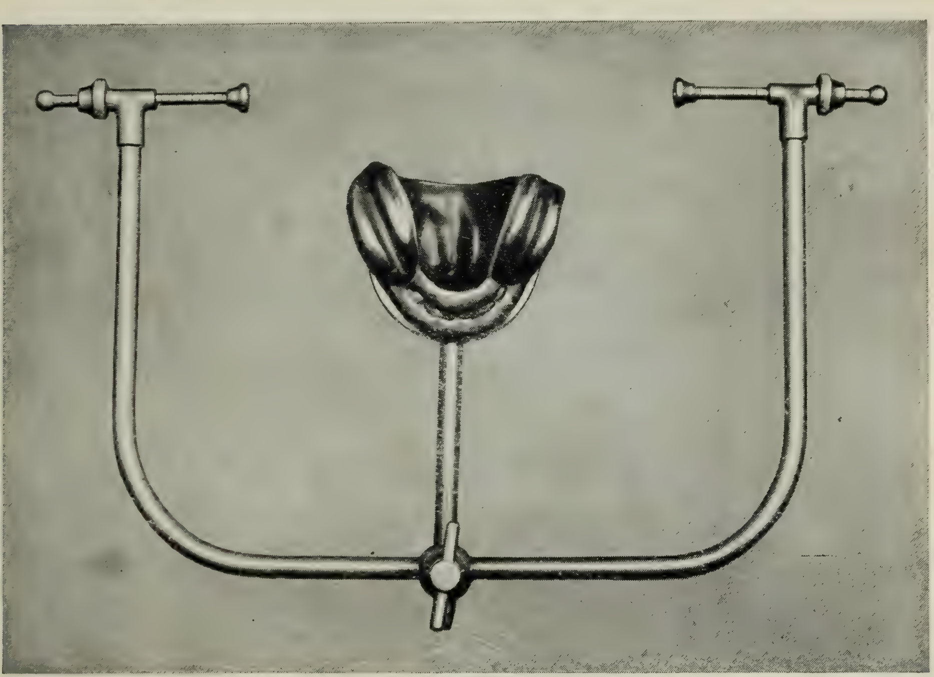


Fig. 134. Shows facebow with bite of a full upper and partial lower impression. Pointers are adjusted as they have been taken from the patient's face. The stem is inserted in the bite plate and the small vise locks the facebow to the stem.

A number of men attempting to simplify this have tried to describe it as a single plane. This is notably true of Monson, who claims it is a curve in which the cusps of the lower teeth rest upon the surface of a sphere which has a radius of four and a quarter inches. This "plane of Monson," or "sphere," can be applied to an ideal case, and then to the lower teeth only, but does not take into consideration the over-bite nor the heights of the cusps of the upper teeth. These cannot rest upon the same plane.

I believe, however, if we are building up a bite to obtain functional

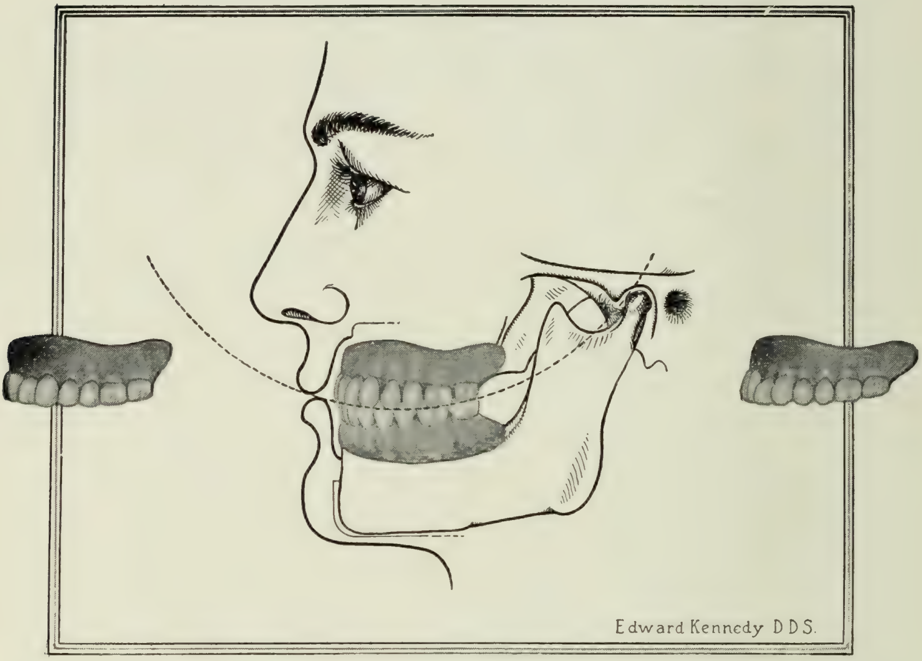


Fig. 135. Diagram showing ideal curve of Spee. The plates at the sides of picture, even though made on the proper curve of Spee, the one to the right being made too close to the condyle, and the one to the left too far away from the condyle, will not fit when placed in the position in which the patient would have to wear them. This would not have occurred if a facebow had been used.

occlusion, the Monson articulator is as good an instrument as there is, to determine just how to obtain this ideal relationship and the making of the bite plates.

I do not believe the plane we are describing will ever be reduced to a single plane. We will find that it is not a sphere but more likely a spheroid, and a different one for the posterior and for the anterior part of the mouth. If the student can conceive of a plane which lies between the teeth, which is somewhat spherical in shape, and which passes through the condyles, or passes through a plane concentric with the plane that passes through the condyles, he will comprehend enough to allow him to understand the working of anatomical articulation and the mechanism of the jaws.

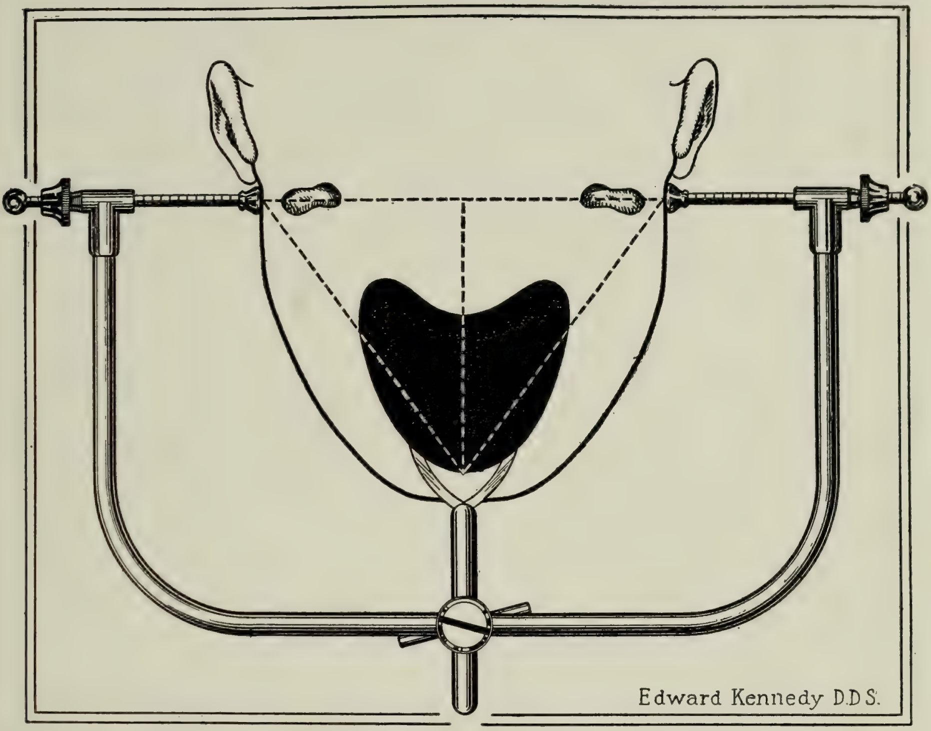


Fig. 136. Diagram showing facebow in position on patient's face. The distance we are trying to obtain is the common altitude of the two dotted triangles, which is the radius of the circle upon which the jaw opens.

The Facebow Described.

The facebow is an instrument which allows us to "orientate" our casts, or, in other words, to place this plane in the same relationship to the condyles of the articulator, as this plane bears to the relationship of the condyles of the patient.

The facebow is simple and easy to adjust. If a dentist takes more than three minutes to adjust it to a patient's mouth he is wasting time. When he comes to use it to mount cases on the articulator he simplifies the process greatly and reduces the error of location, sometimes from an inch from its correct position down to a millimeter.

There is a type of mind which discards the facebow as inaccurate because it does not reduce this error of a millimeter to no error at all, yet that same mind is satisfied to go on making errors which are gigantic, because one cannot obtain an instrument which will reduce them to microscopic size. I have no patience with this sort of quibbling, and I believe that every case would be better handled on an anatomical articulator using a facebow, whether it be a full case, partial case or bridgework.

If it is important to mount casts on an anatomical articulator with a facebow, when they are to be used in constructing comparatively cheap platework, made quickly, and which cannot do a great amount of injury to the patient when it fails, how much more important is it to mount casts to be used for complicated bridgework, on an anatomical articulator with a facebow and thus prevent trauma, which may produce untold injury to the patient by the loss of abutment teeth.

The facebow is an instrument that registers for us the distance from a line drawn through the condyle about which the jaw starts to rotate in opening, to the center line of the lower anterior teeth, and this distance is the radius of the circle on which the jaw opens and closes, (Fig. 136) so that when this distance is maintained in mounting our casts on the articulator, the teeth on these casts will open and close on the radii of the same circles as they do in the mouth, and the bite can be opened or closed slightly on the articulator, without having to remount the casts when we are setting the artificial teeth.

The facebow does another thing; it locates casts in the same plane in relation to the earth's surface as the natural jaws occupy. This is what is meant by "orientation." The casts may tip down on one side or at the back, and when first using the facebow the student is apt to think that he is in error. If he places the bite plate of the facebow in the mouth, he will find that he is not in error.

I have seen men mount their cases on an anatomical articulator without the aid of the facebow, so that everything was symmetrical on the articulator; that is, the center line and the tuberosities of the casts were an equal distance from the condyles of the articulator, and the plane of occlusion parallel to the model supports of the articulator. Yet the result was, that when they came to try the case in the mouth, (if it was a full upper set), the teeth hung down on one side giving a very ugly appearance, whereas this would not have occurred if they had used the facebow.

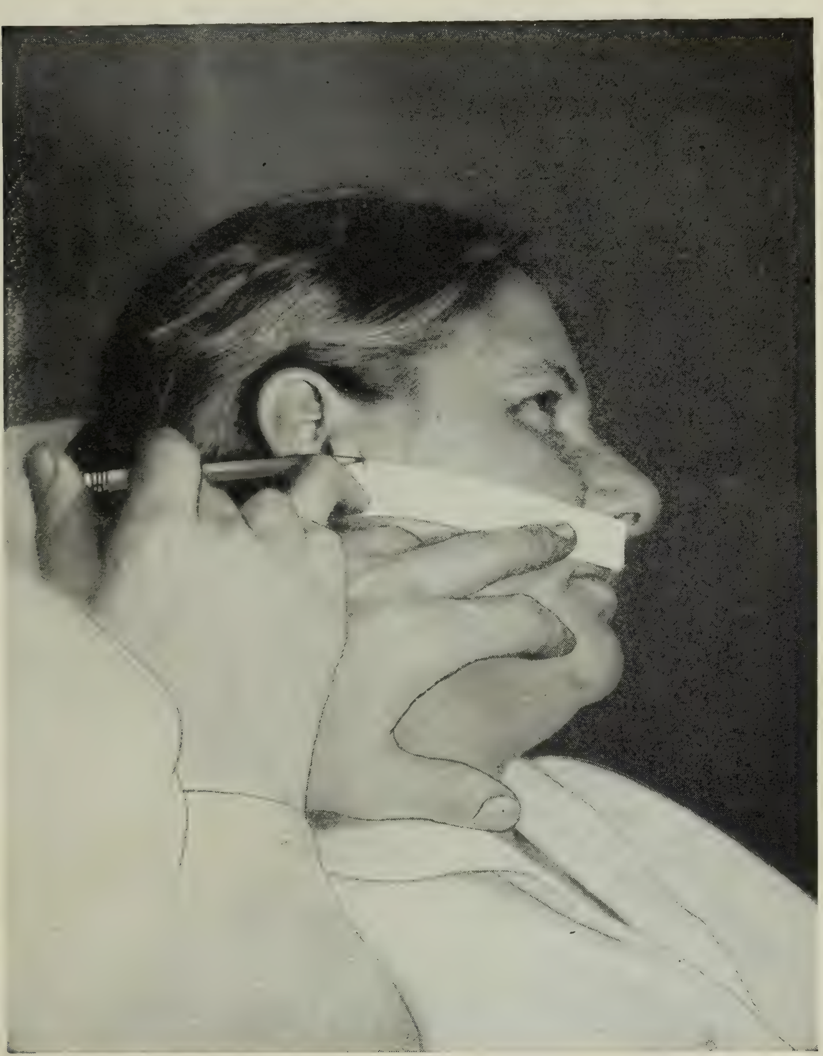


Fig. 137. Marking condyle, one-half inch anterior to the opening of the ear on a line drawn from the tragus to the ala of the nose. Lead pencil point shows wrinkle.

Locating the Condyles.

In adjusting the facebow on the patient, it is a good idea to mark the location of the condyles with a soft lead pencil. I find that most patients have wrinkles just anterior to the opening of the ear, and the condyle when at rest lies back of these two lines. (Fig. 137.) By placing a finger at this point you can feel the condyle move. Try this over your own condyle and you will have a good idea of its location.

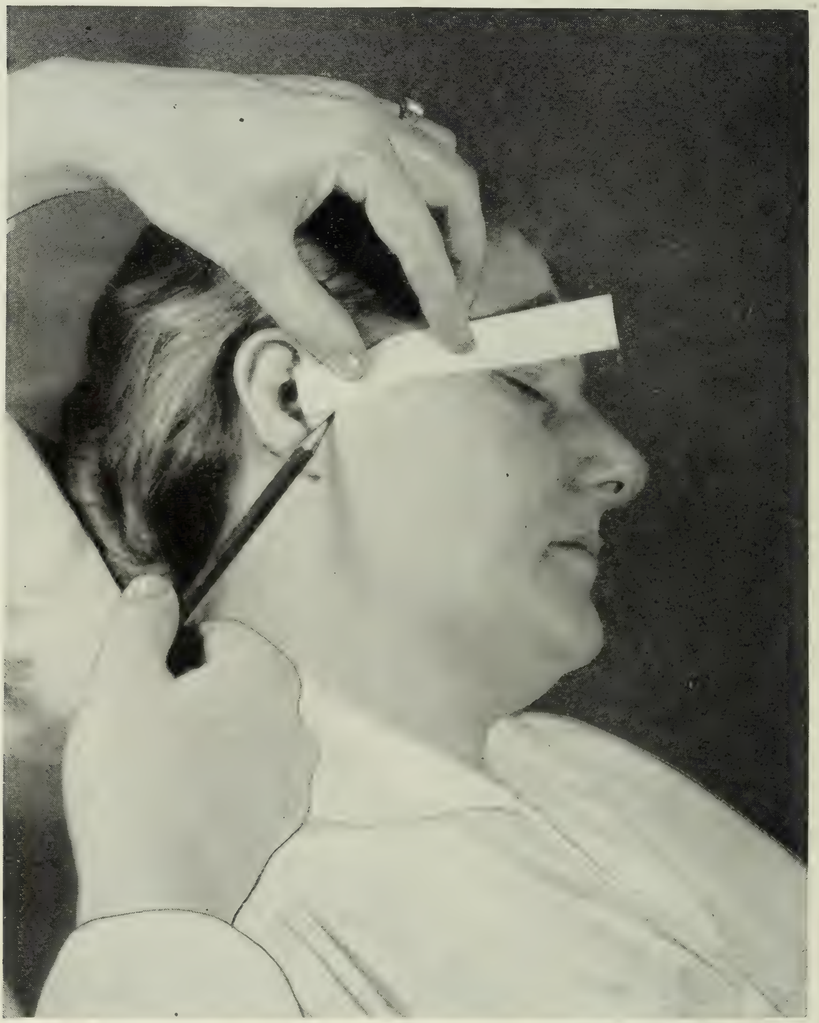


Fig. 138. Another method of marking; one-half inch out from the point of the tragus of the ear to the corner of the eye. These two marks will be about half a millimeter apart. Hence, I place a mark midway between.

The classical way to find this point has been to draw a line from the tip of the tragus, which is the little point of the ear just anterior to the opening of the auditory canal, to the ala of the nose, measuring a half inch out on this line from the opening of the ear making a dot on the patient's face. (Fig. 138.) Another suggestion was to draw a line from the tragus of the ear to the corner of the eye and measure out a half inch from the opening of the ear. As these cannot

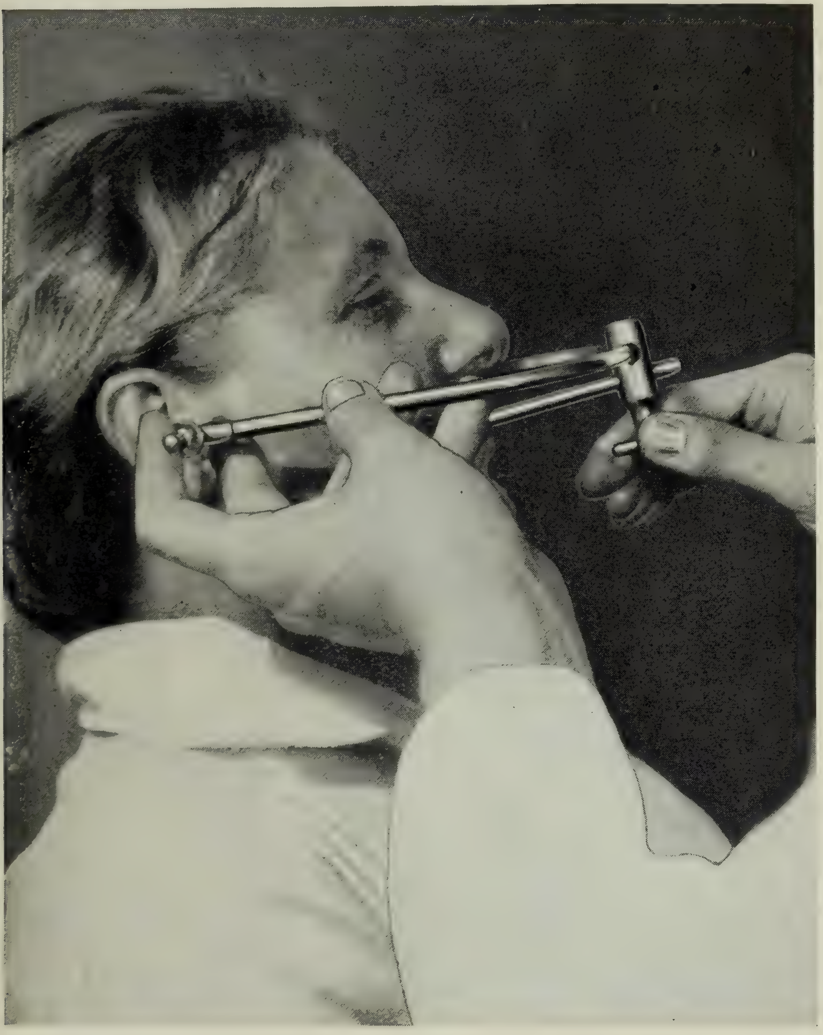


Fig. 139. Proper manner of holding facebow with the thumb and fingers. The second finger supports the pointer on the mark.

be the same, I split the difference and put my dot half way between these two points.

Setting the Facebow.

Next if we examine the facebow we will see that the pointers have a number of lines drawn around them. These pointers rest over the dots on the patient's cheek, and there should be an equal number of rings showing on either side of the facebow. To do this very rapidly, push one side in to its fullest extent, lock it and allow the other side to work free. The facebow is placed on the patient's face, the locked side over one of the dots and the other side adjusted so that it just slightly touches the face. The number of marks beyond the facebow are counted, this number is divided by two and both sides of the facebow adjusted to this number, and locked. It is then tried upon the patient's face to make sure that the adjustment is still correct and this will center the facebow upon the patient's face. The stem best suited for the case is attached to the upper, or lower bite plate.

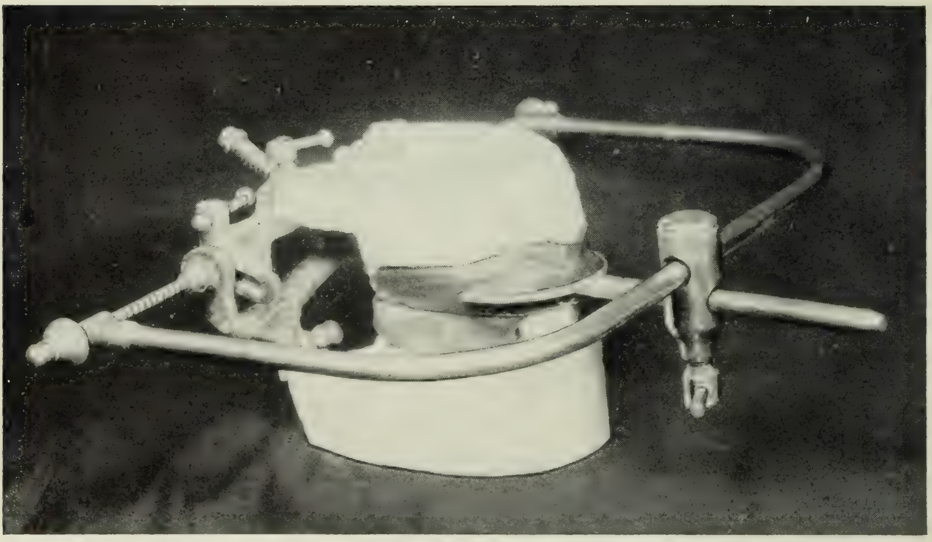


Fig. 140. Facebow adjusted to the articulator, and the casts attached with impression plaster.

Attaching the Bite Plate.

It makes no difference whether it is in the center line or not, but it is neater to have the stem in as nearly a central position as possible. When inserting the stem in the bite plate, the ends are heated and forced into the wax, or compound. This is best done when we start the operation, that is to say before we adjust the bow to the patient's face so as to allow it to cool sufficiently to insert in the patient's mouth. I have seen patients burned as the metal retains heat for a considerable length of time. I try to keep the stem parallel to the bite plane. (Fig. 139.)

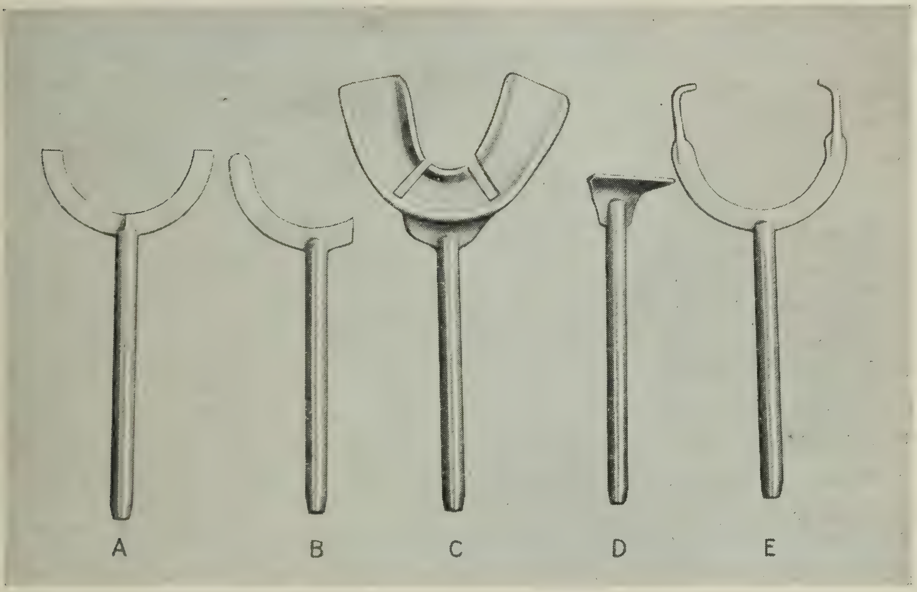


Fig. 141. Stem attachments for facebow. (A) Regular attachment. (B) Where teeth are on one side of mouth only. (C) Tray used on cases where bite plate cannot be used. (D) Where anterior teeth are lost or where we are taking plaster squash bites in front of mouth. (E) Stem used where anterior teeth are present to grasp bite plate in the posterior part of mouth.

The patient is asked to close the mouth upon the bite plates and hold them tightly. The stem of the facebow is then inserted in the hole in the vise. One pointer is held over the mark on the right side of the patient's face supported by the second finger, the thumb and other fingers supporting the facebow. (See Fig. 139.) The other pointer is adjusted over the mark and the vise is tightened. After this the patient is examined to see whether the pointers are directly over the marks on the cheeks. If these marks are made with a soft black lead pencil they will easily rub off. One should therefore be careful not to erase them.

It is very simple to adjust the facebow if you have an assistant, as she can watch one side while you take care of the other. At times it may be necessary to ask the patient to tighten the vise.

To recapitulate. If we think for a minute, we will see that we are measuring the distance from the condyles to the center line and holding in the vise a bite plate which registers any tipping of the ridges, but the skin and the tissue is in the way over the condyles and we are actually measuring a triangle larger than that which we will have when we come to the articulator. We will find that when we come to place the casts on the articulator, the facebow will not fit. We will be compelled to push the pointers in to make them fit the articulator, as we are not concerned with the sides of the triangle but with its altitude. (See Fig. 136.) This will make no difference if we push each pointer in exactly the same distance, as we are shortening the sides of the triangle only, and not altering its altitude. Of course, we must be careful to have the pointers set at equal distances to start with; that is an equal number of rings must be exposed beyond the bow, and when we push these in to fit the articulator, we must see that there are still an equal number of lines on each side; otherwise we would be altering the altitude of the triangle, by tipping it either to the right or to the left.

This really is the only thing that requires any great degree of accuracy in adjusting the facebow, after we have located the condyles. The facebow is placed upon the articulator, the casts are put in the bite plates, and are held firmly by using either sticky wax; thread to bind them tightly, which can be cut after; or rubber bands, which also can be cut.

If we are using an articulator which has a fixed descent of condyles, such as the Grittman, or the Gysi Simplex, we must be sure that the model supports are parallel, and do not touch the plaster when we come to mount the casts; otherwise we would alter the descent of the condyles.

Likewise, with these fixed path articulators, the bite plane must be so elevated, or depressed, by raising or lowering the front of the facebow, that the bite plane is parallel to the model supports of the articulator. This may necessitate the trimming of our casts if they are too high.

If we are using an articulator which has an alterable descent of the condyles, like the Snow, Snow Acme, Hanau, Gysi Adaptable, or Wadsworth, this makes little difference, with the following two exceptions. First, if you are running a series of cases and are comparing the descent of the condyles to each other in each case, then you must have some fixed point at which to set the plane of occlusion. Second, if you are not following the technique of altering the condyle paths and using it as the Simplex, or Grittman articulator is used, it will be necessary to set your descent of the condyle at one point, preferably the average of 35 degrees, and then have a fixed spot for setting the bite plane.

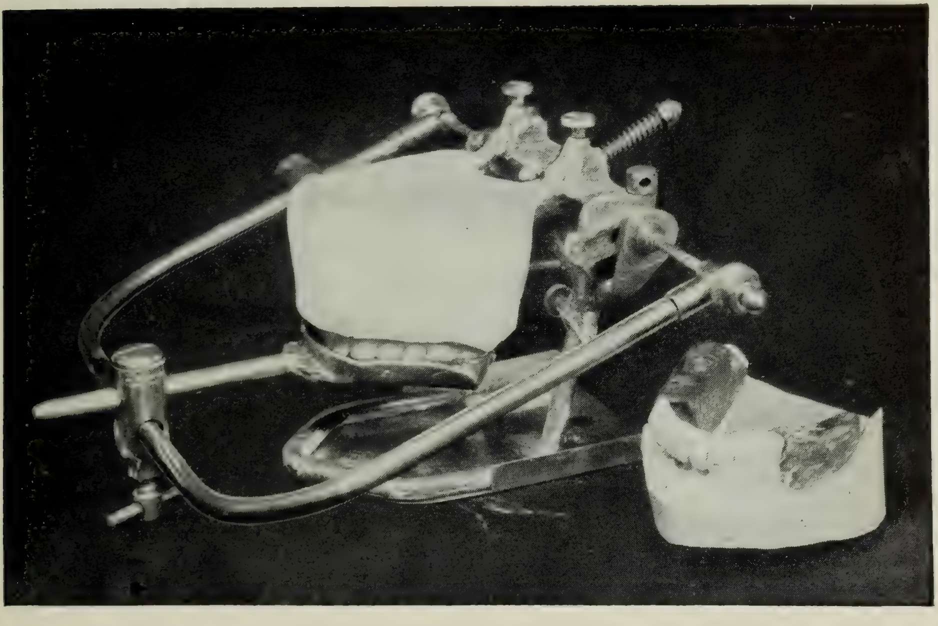


Fig. 142. Tray used to mount upper cast, where all teeth are present. The lower cast is then mounted to the upper, using a bite plate.

This can be done very simply if you keep the bows of the articulator parallel, and see that the bite plane is parallel with them. It is generally my practice to mount the upper cast first, and then, reversing the articulator, to mount the lower case. I do this with impression plaster as it sets more quickly and is easier to remove.

Facebow Stems.

There are a number of different stems, as shown in Fig. 141, and these are used for different types of partial cases. Sometimes in partial

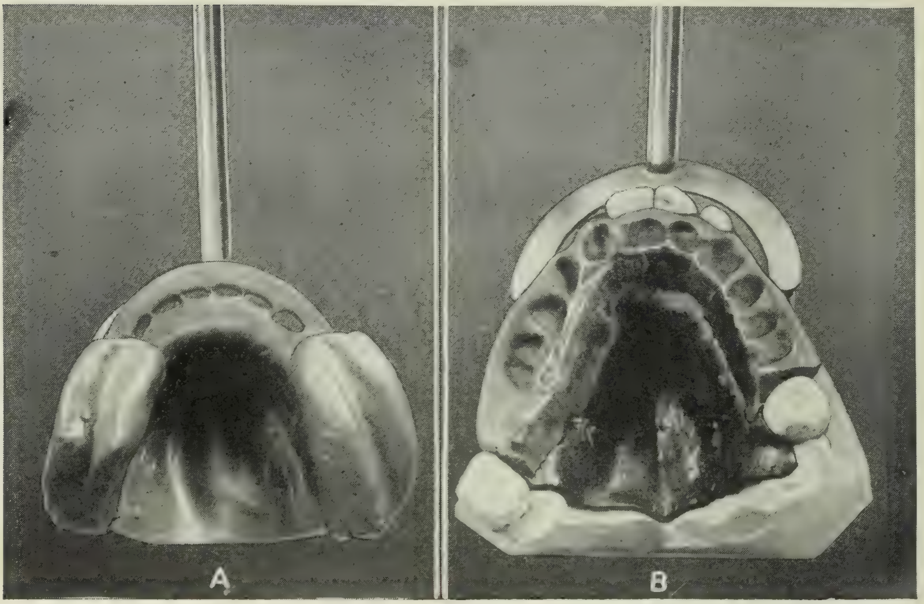


Fig. 143. Bite plates showing the impression of the occluding teeth. Stem of facebow inserted ready to take the bite. A. Full upper, Class I lower. B. Class II upper, natural teeth present below.

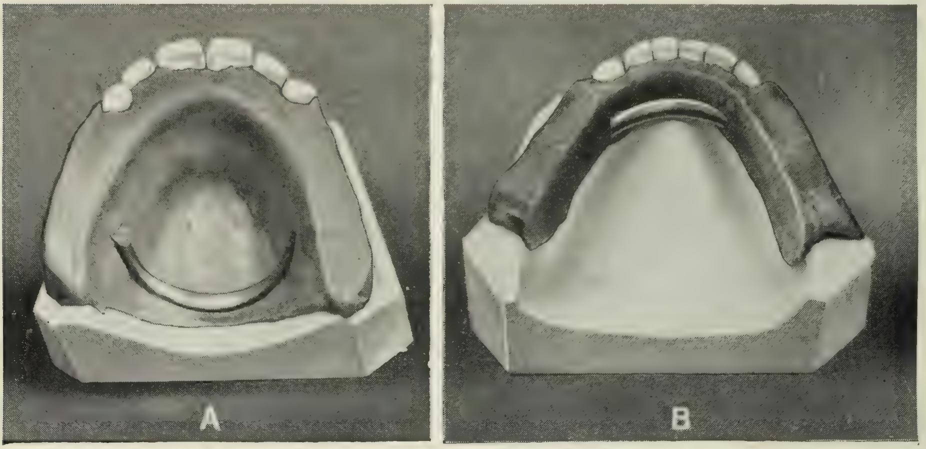


Fig. 144. Bite plates made of wax strengthened with wire. A. Upper. B. Lower.

cases it is impossible to use any of the regular stems that can be obtained, and we must alter them to suit the case. I have found those in Fig. 141 most universal.

There is a stem made for mounting orthodontia models and casts of cases for which you have no way of making the usual bite plates; those cases which have a sufficient number of teeth in occlusion to allow us to mount them without a bite plate. This stem is made by taking an S. S. White No. 17 tray and soldering it to a facebow stem. This tray can be altered to fit any cast and a small quantity of wax, preferably beeswax, is placed in it and forced either upon the upper or lower cast, getting the imprint of the teeth in the wax. (Fig. 142.) We then place this in the patient's mouth and adjust the facebow to it. When it is placed back upon the articulator the cast is put in this wax impression and mounted. Then the second cast is adjusted to the first and mounted.

In adjusting the second cast to the first one, if there are a number of openings between the teeth, it is best to make bite plates, or bite impressions, or use one of the methods which will be described later.

Cast Relationship

Cast relationships, as I have stated, should be considered separately from the facebow relationship. The facebow is used to orientate one of the casts. The bite plate is used to relate this cast to the other. In some cases the two can be done at the same time and thus save one step in the operation as shown in Fig. 143. At other times it is much better to make separate bite plates.

The assembly of the casts is most inaccurate if wax squash bites are used, as the wax is so liable to become distorted when it is taken from the mouth. If a wax bite plate is used it should be strengthened with pieces of wire which are soft enough to be bent with a pair of pliers, but stiff enough to resist the biting force. (Fig. 144.)

Class I, upper case, bite plates can be made of some one of the shellac bases, such as Perfection or Graft's, or may be swaged of soft metal such as aluminum or pewter, (Fig. 145) or made of rubber. The rims are built upon them with wax or modeling compound.

Class I Cases. Let us assume that we are dealing with a simple case of Class I, upper, where all the natural teeth are present below. The rim of compound, or wax, is heated, and the patient is allowed to bite into it. It is then trimmed off until just the points of the cusp marks are left showing, and it is noted whether the anterior teeth come together. The student should instruct the patient to close the mouth without the bite plate

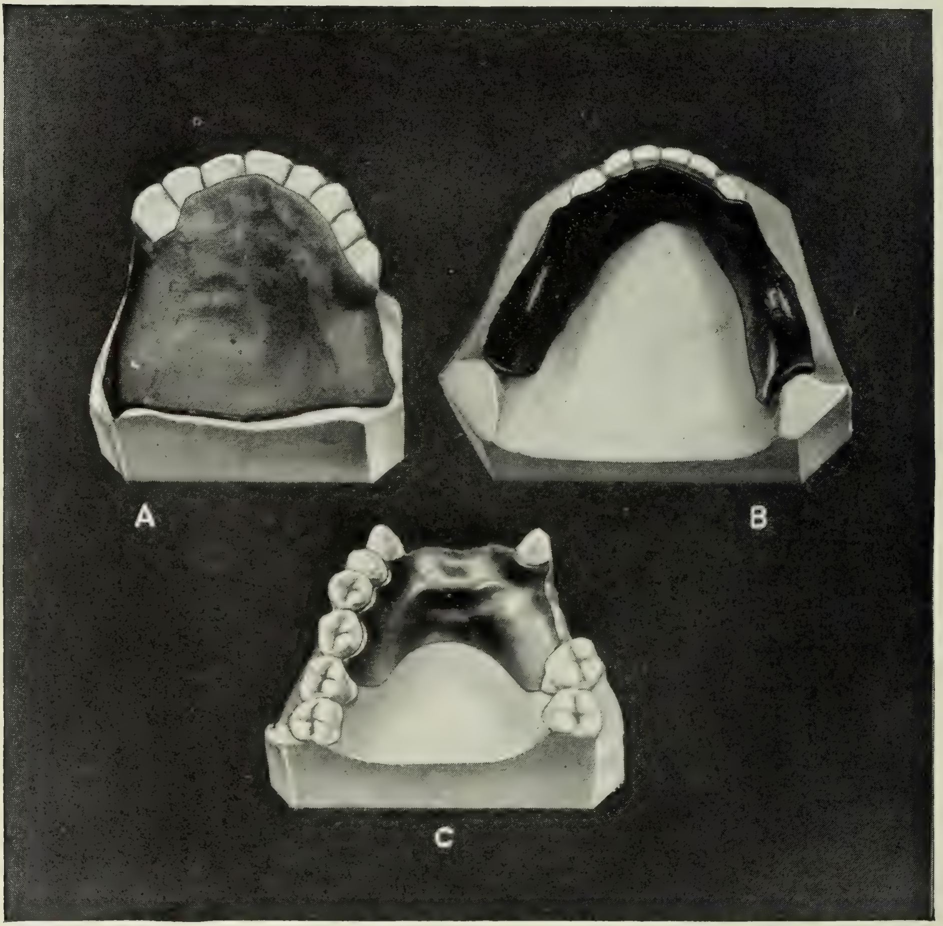


Fig. 145. Base of bite plates made of Graft's (A) or Perfection (B) shellac; vulcanite or metal (C).

in position, and he should see how the anterior teeth occlude, and note the facets upon which they strike. This is very important because the teeth may seem to occlude, but the mandible may be protruded, or slightly out of central relation, and if this position is maintained through to the finished plate the patient will never be comfortable. When taking the bite the mandible must close in correct central and in its most distal relationship. I believe this is the most important factor in the construction of dentures, whether they are full or partial, and it is the proper determination of this position that spells the success or failure of the denture.

If, upon closure of the mouth upon the bite plate you notice that the facets worn upon the surfaces of the teeth are in contact, you should check both sides of the mouth, as you may have contact on one side and not on the other. If a sufficient number of anterior teeth are present, and the facets worn on the teeth are well marked so as to give good relationship, it is not necessary to build wax or compound upon the anterior part of the bite plate; but if the teeth do not come in contact, or if teeth are missing as in Class I, modification cases, it will be necessary to build the bite up with wax or compound. (Fig. 146.) If this is not done, when we put the lower cast into the upper bite plate we are apt to have tipping.

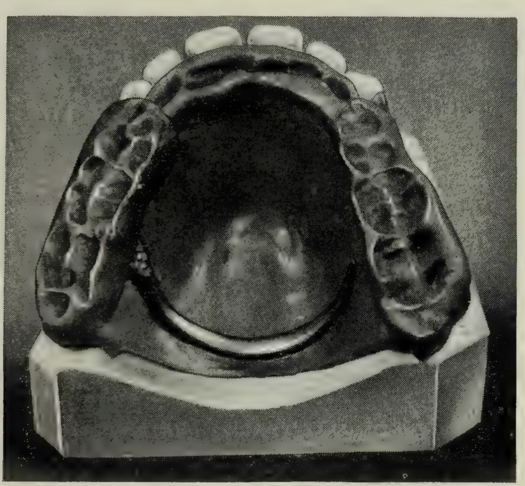


Fig. 146. Class I upper case impression of lower occluding teeth. Wax rim built both on the anterior and posterior part of the base.

It is best to build our bite plates with the rim on one side only, so that we can see when we are taking the bite, whether the teeth come into correct contact on the opposite side of the mouth. The impression of the occluding teeth is obtained on one side, and then the rims are built up on the opposite side of the bite plate and the rims trimmed so that the occlusal surface of the occluding teeth shows only on the bite rim. If a large mass of wax, or compound is allowed to extend up, to cover the buccal or occlusal surface of the occluding teeth, when it is hardened you will find that it is almost impossible to force the cast into this material. To overcome this, some men use soft beeswax to allow slight distortion so that the cast can be forced into it; this again usually produces a false bite.

The occluding casts are best made by taking the impression of the occlusal surface, and about half of the buccal and labial surfaces of the occluding teeth, with modeling compound, in a stiff impression tray which does not allow distortion, and pouring the same in artificial stone. This impression can be taken in complastica, or plaster and this cast poured in one of the fusible metals, which gives a hard surface against which to articulate the teeth of the denture.

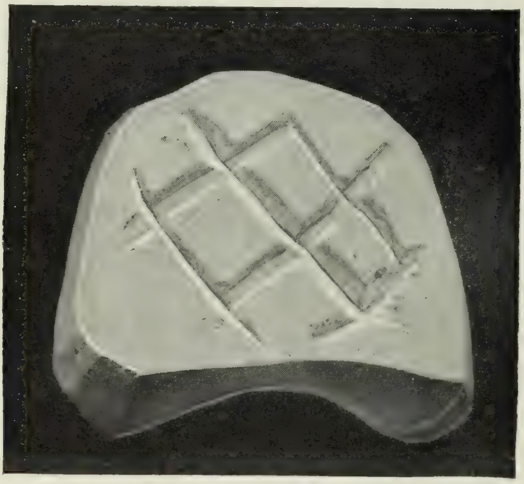


Fig. 147. Cast showing V-shaped grooves. In case it is displaced from the articulator it can be readily relocated.

The student must bear in mind that I am talking about a case where we are supplying the teeth in one jaw only. These occluding casts are made of the opposing jaw, only where most of the teeth are present, or are represented by bridgework or platework. If we are making two dentures for the same mouth, other methods must be followed which will be described later. The bite plate is placed into position on the cast, which is mounted on the articulator and sealed there with a small quantity of wax; then this occluding cast is placed into position and sealed to the bite plate with wax. The articulator is closed and the occluding cast is attached to the model supports of the articulator with impression plaster.

It is always a good idea to cut V-shaped grooves (Fig. 147) in the under surface of all casts, so that if by an accident they become displaced, they can be put back on the articulator in their proper relation, these grooves acting as keys.

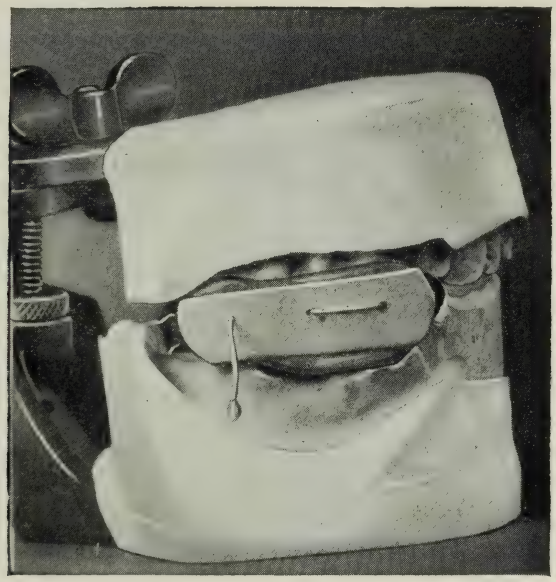


Fig. 148. Squash impression bites, cut narrow, for articulating a Bonwill type of case.

Class II Cases. In Class II cases it is best to build base plates so that they will receive support on the side of the mouth opposite from the saddles. The wax, or modeling compound bite rims, are built upon these base plates on the saddle portions only, in the manner described above, leaving only the occlusal impression of the teeth showing, and when it has been determined that the teeth come into proper occlusion, a small amount of wax is built around to give us support against the anterior teeth so that when the occluding cast is mounted, we do not get a forward and backward tilting motion and a false bite.

If it is a modification of Class II, with openings in the anterior or posterior portions of the mouth, opposite the saddle, the bite rim is built up in these spaces and handled in the same manner as the saddle portions.

Class III Cases. In Class III cases where there are extensive saddles it may be necessary to build bite plates with bite rims upon them, but in this type of case where the teeth have facets well worn upon them, the casts can sometimes be occluded without the use of bite plates. In this type of case we can sometimes use the squash bite impression method described earlier. If this squash bite impression is to be used only for the purpose of articulating casts which have already been poured, we must make it shorter in height than that which is shown in Fig. 148.

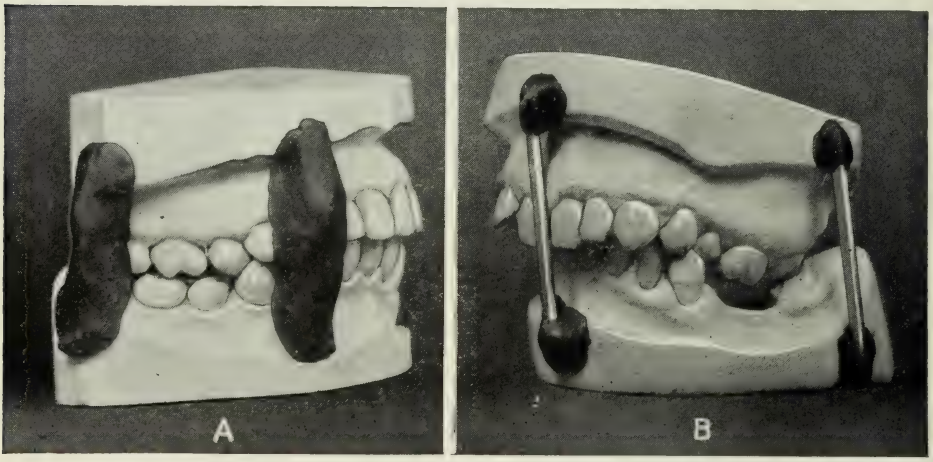


Fig. 149. Articulating casts without the aid of bite plates. Sealed together with rolls of yellow wax (A) or match sticks (B) fastened to casts with wax.

In making bites for the Bonwill type of bridgework, (which falls under Class III impressions), we can follow one of two procedures. We can make either separate impressions for the bridge cast and the surfaces of the occluding teeth and articulate these in a small squash bite impression, or take an impression for the bridge, pouring it in stone, then take a squash bite impression, place this upon the stone model, pour the opposite side in stone and attach it to the articulator together with the stone cast.

Class IV Cases. In Class IV cases where there are not more than four anterior teeth missing it is seldom necessary to make a bite plate. The cast can be occluded without its use. But if we encounter cases where there are six or more anterior teeth missing we would better make a bite plate, so as to preclude any possibility of any forward or backward tilting of the occluding cast, and thus avoid a false bite.

In occluding casts without the aid of a bite plate it is a good plan to tie the casts together with cord, or rubber bands, which can be cut after the plaster is attached, or to attach them to each other with wax. I do not use sticky wax because I have found that very often, in attempting to remove it from the cast, it pulls pieces of the teeth with it. Pink wax, or yellow beeswax can be used, but if the cast is the least damp it will not adhere. A good method is to make a roll of wax, soften it and press it against the sides of the teeth; then with a hot spatula seal it above and below where the gum is represented on the cast (Fig 149 A). About three of these pieces will be necessary to hold the cast together. I worked with a man once who used match sticks, laying them on the sides of the cast which represented the base and sealing them with sticky wax, (Fig. 149 B). Three of these sticks are sufficient to hold the cast together.

Technique for Dentures in Both Jaws.

Where we have a denture to construct for both the mandible and maxillæ we follow a different procedure. A full upper case with a Class I, lower, can be made in the manner shown in Fig. 143 A. That is, a bite plate is made by one of the recognized methods and the rims built up to establish the esthetics. When the proper fullness has been obtained, the length is determined with its low and high lip lines and center lines marked. Then the edge of the bite rim is heated, and the patient is allowed to bite into it for a depth which we would consider to be his normal overbite. It is not necessary to make a bite plate for a Class I, lower, which is to occlude with a full upper. All that is necessary is to build a roll of wax upon the posterior part of the bite rim, on one side of the mouth. This is rather difficult to do directly in the mouth, therefore I take the upper bite plate and put it upon its cast and build a roll of wax upon the rim, making it longer than desired for the finished bite; then I press the lower cast into this softened roll, so that the teeth come into the marks already made in the upper bite plate. This gives us the approximate relationship of the ridges. While the wax is still warm, it is placed in the mouth and the patient directed to close the mouth, the upper bite plate being held by the fingers. I prefer pink paraffin wax for this purpose. When the patient has closed the mouth, if the wax does not come down and touch the ridge, the bite plate is taken out of the mouth and the roll of wax squeezed between the fingers to increase its height and then placed back in the mouth and the patient is directed to bite again. As a rule we obtain the correct impression of the ridge on the second insertion of the bite plate. The same procedure is followed on the opposite side of the mouth. In this type of case the facebow can be used, by attaching the stem directly in the upper bite plate, and making the necessary adjustments of the facebow.

With a full upper and a Class II lower, the same procedure is followed except that here we obtain the impression of the occluding teeth in the rim of the upper bite plate, and build a roll of wax on the saddle side only. With modifications of Class II, the same procedure is followed.

With a full upper and a Class III lower, or Class III lower and its modifications, it is not necessary to build a lower bite rim, as the lower cast can be occluded to the upper bite plate directly.

Class IV lower cases, with full upper dentures do not need a bite plate for the lower, unless there are six or more teeth missing. If there are six teeth missing, a roll of wax can be built upon the anterior part of the upper bite plate, and the same procedure followed as described for Class I, and Class II, lower, except that the location of the roll of wax must be on a different part of a bite plate. If, however, it is a Class IV lower, and there are only a few teeth on each side posteriorly, it is best to handle the bite plates as you world for a full upper and lower case.

In all cases of full upper and partial lower cases, the facebow can be directly attached to the upper bite plate and that cast mounted on the articulator. The lower cast is then attached and mounted. Where we have a partial upper and a partial lower, a Class I upper with a Class I lower, we build a bite plate for the upper with its rim. Then upon the rim we can build rolls of wax downward to the ridges, in the same manner as we did with a full upper and Class I, lower. After this is done it is well to build a small rim of wax to engage the anterior teeth of the lower, to prevent the forward and backward tilting of the casts when mounting them.

With a full lower and a Class I upper I build the lower bite rim and reverse the procedure of the full upper and Class I lower, by building rolls of wax upward to engage the upper ridge. I sometimes, however, make separate bite plates as there is less chance in this type of case, of getting out of central occlusion, if we carve the bite rims so as to allow the patient to move the jaws in any direction. In this type of case the facebow can be attached directly to the lower bite plate.

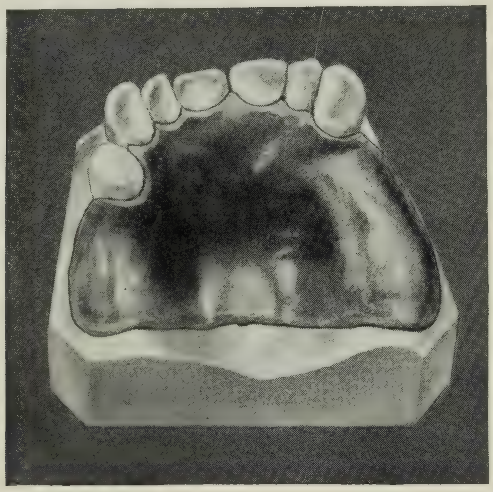


Fig. 150. Vulcanite bite base prepared for open-bite cases.

There are numerous other combinations and it would require many pages to describe each separately. The student will need to use his ingenuity in deciding which is the best method, using the attachments for the facebow, shown in Fig. 141 and making other attachments that will suggest themselves from time to time.

The facebow measurements can be taken at the same time when we take the bite, thus saving one step. However, the tray attachment to the facebow requires such a short time to adjust that if the student is in doubt as to what method to use, he can use it separate from the bite plates and be on the safe side.

Vulcanite Base Plates.

In cases where it is necessary to open the bite, make a wax base plate upon the casts to the outline of the finished denture. Placing this in a vulcanizing flask, separate it, pack rubber in it and vulcanize it. (Fig. 150.)

It is a simple procedure to make one of these base plates of vulcanite. They hold well in the mouth, are accurate and do not become distorted. Upon such base plates modeling compound rims are built, and the bite is opened to a sufficient degree to satisfy the operator. These rims should be trimmed on an ideal curve. This can be done in the mouth by having the patient move the mandible from side to side, until the bite rims slide over one another, maintaining contact, in all positions. This is difficult for the beginner. It is, therefore, advisable to obtain the bite upon these, with only central relation, and the proper height restored, then mount one of the casts on an anatomical articulator with the facebow. Next place the bite plate in position and mount the other cast. When they are sufficiently hardened to allow working, the bite plates are separated and trimmed to establish the correct plane of occlusion, which will permit oscillating motions of the mandible and still maintain contact between the bite plates at all points.

The bite plates are then placed in the mouth and any discrepancy noticed. If there is any, it must be corrected in the mouth and the articulator adjusted to the change, or one cast remounted to correct it.

The writer has found the Monson articulator an excellent instrument for this purpose, and when articulators are discussed in a later chapter there will be a more complete description of this method.

CHAPTER IX

Use of Articulators

There has been a great deal of discussion as to the kind of articulators to use, also as to the correct name by which they should be called.

I believe the name articulator is the proper one, as it is an instrument upon which we articulate artificial teeth. Webster's International Dictionary says that an articulator is "An apparatus used in dentistry for obtaining correct articulation of artificial teeth."

Articulation does not mean the movement of the teeth of opposite arches upon one another, but the placing of artificial teeth in their proper positions.

The old dentist placed his casts together, varnished the back edge with some separating medium, settled the cast into a mass of soft plaster and allowed it to harden. This made a matrix which held the two casts together, and when they were working upon one or the other, that cast was lifted from its matrix. This was called the "slab articulator." (Fig. 151.) It was modified in different ways and was very efficiently used where small bridges were being constructed.

Dr. Peeso invented a plate of metal which has markings upon it, and when pouring the lower half of his squash bite impression he allowed the plaster to extend about an inch and a half distally as shown in Fig. 152. While the plaster is still soft the plate is pressed down upon it and the plaster allowed to harden. When this has occurred the plate is removed leaving a smooth surface with a T-shaped ridge upon it. This surface is varnished with a separating medium and the second half of the bite poured. When the impression bite is separated the T-shaped ridge will serve the purpose of a crude mechanism for raising the bite, as the teeth slide over one another, and I believe this was the first step in attempting to obtain anatomical articulation in bridgework.

Later, the Kerrs produced an articulator for small bridgework.

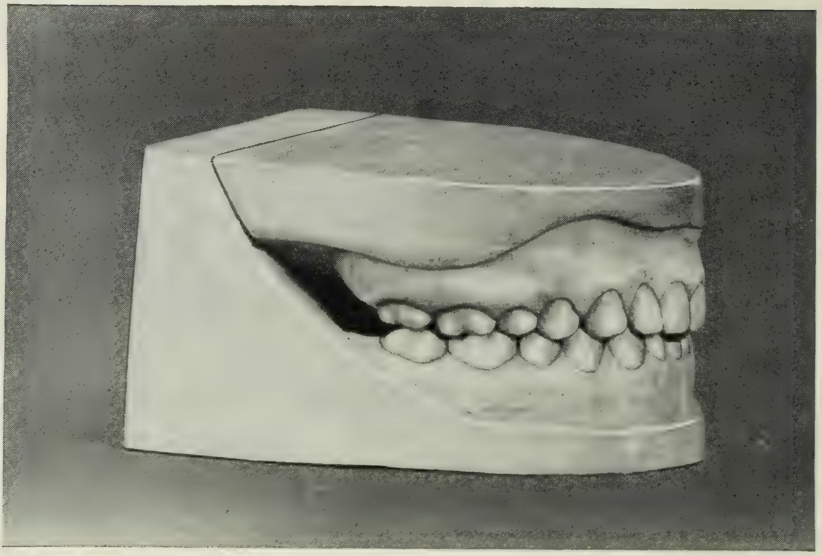


Fig. 151—Modification of the Slab Articulator.

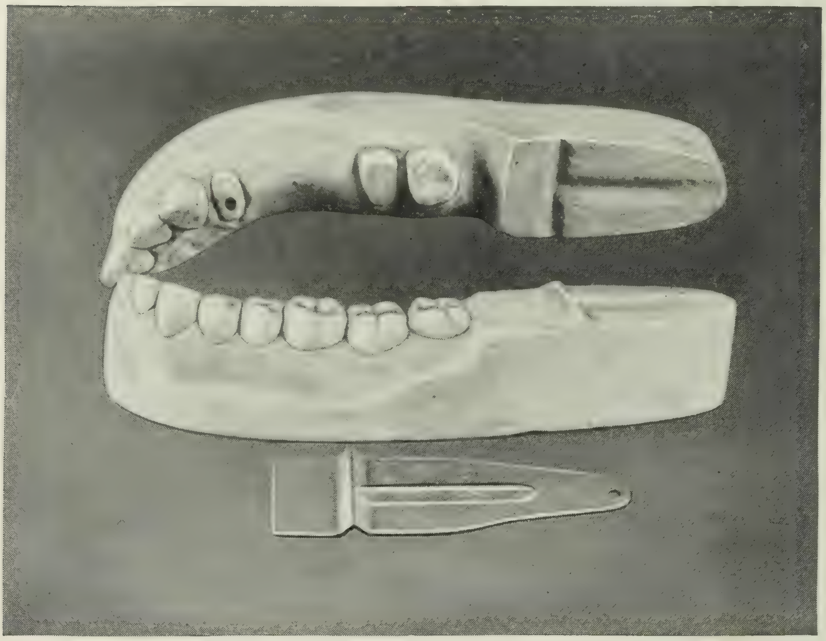


Fig. 152—Slab Articulator made with a Peeso Plate showing plate.

They had several designs, all of which worked very well, and they are still upon the market.

There were numerous attempts along this line, but it was not until the advent of the articulators of Grittman and Snow, and the facebow, that any real attempt was made on the part of the dentist to use an anatomical articulator for his partial plates, or bridgework.

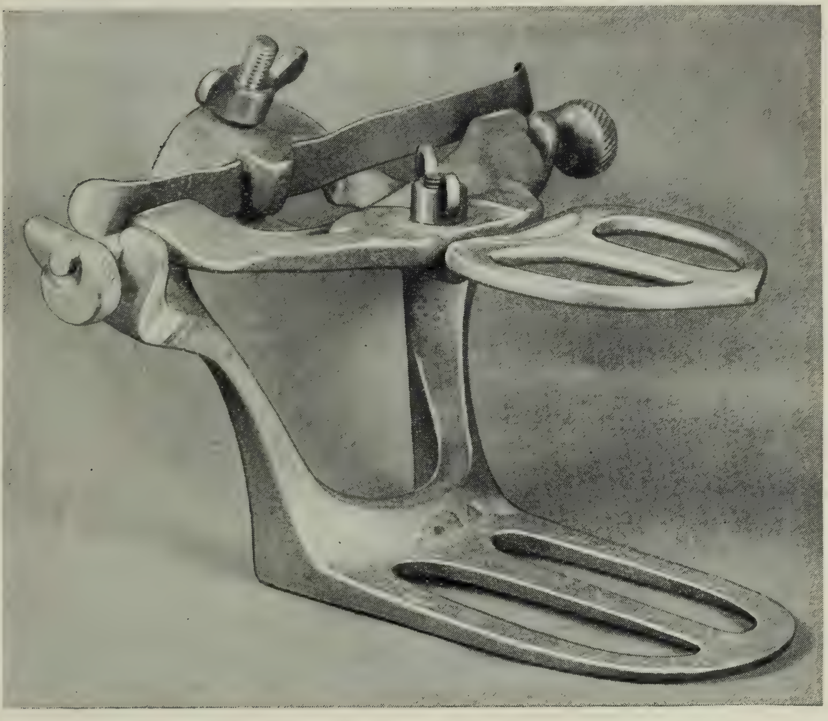


Fig. 153—Stephan Articulator.

If the artificial teeth in bridgework, or partial plate work, do not occlude correctly in the various movements of the mandible, sooner or later the abutments are lost, due to the excessive stresses placed upon them. It is not always possible to produce an ideal occlusion, or even a functional occlusion, in partial plate work, but the utilization of an anatomical articulator is such an advance over the slipshod method of the slab, or plane line articulator, that it behooves every dentist to make the attempt.

The anatomical articulators can be placed roughly into two classes, those which have fixed descents of their condyles and fixed rotation points; and those which have adjustable descents and adjustable rotating points. In the first class are the Grittman, Stephan, and the Gysi Simplex. In the adjustable class are the Snow, Hanau and the Gysi Adaptable. I believe that the Monson articulator should come under the first class, but its adherents claim that it should be placed in the second class. It has less guidance in its movements than any of those I have included in the first class and therefore, in the very narrow limits which are necessary in articulation of bridgework, or partial platework, it checks very well with the results obtainable in articulators of the second class.

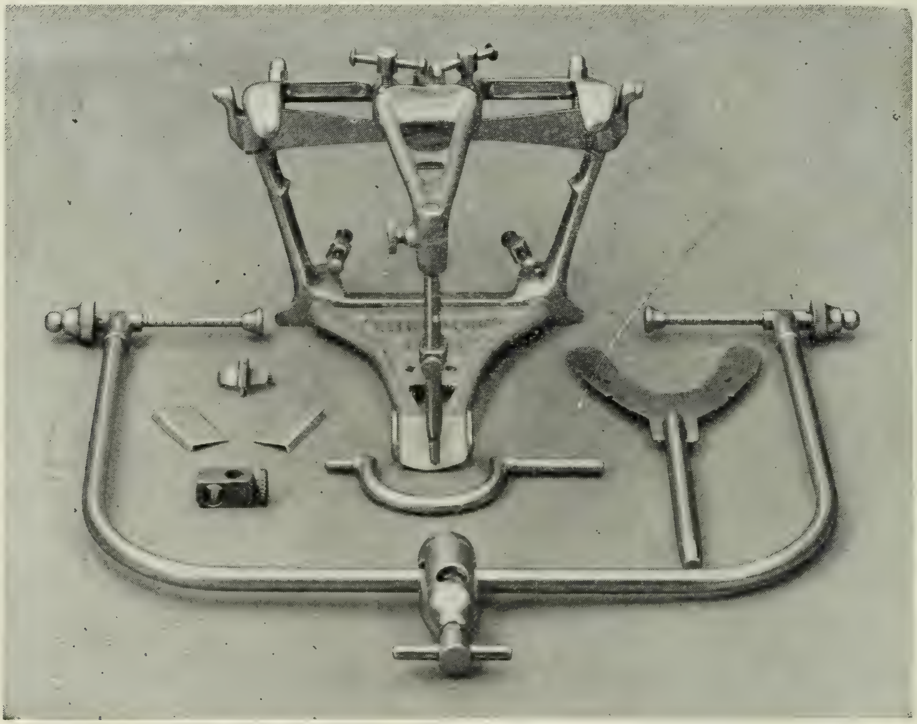


Fig. 154—Gysi Simplex Articulator.

I think there has been a great deal written about, and a great many false claims made for anatomical articulation. If we stop to think, the movements we are concerned with in partial platework, or bridgework are only over the surface which corresponds to half the area of a bicuspid tooth in any one direction. Therefore, if we have casts articulated upon an articulator which allows the natural teeth to remain in contact through this degree of movement, that articulator will do all the work required of it in an efficient manner. The modern method of check biting, introduces errors which negates readjustments of the most complicated articulators.

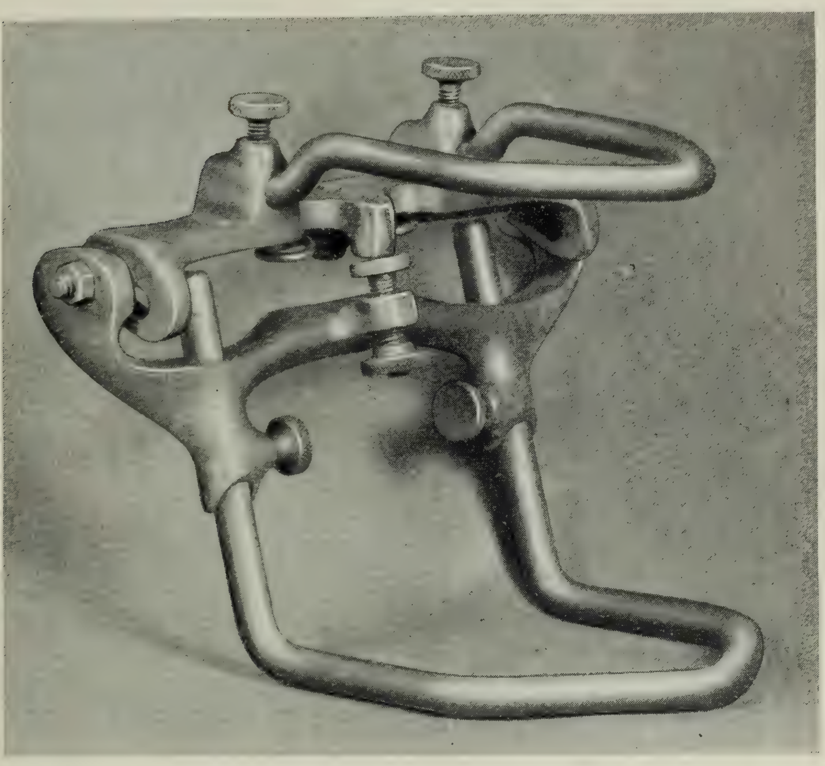


Fig. 155—Grittman Articulator.

I have been unable to obtain check bites on any of the adaptable articulators, which will accurately reproduce movements of the mandible where there are thirty-two teeth occluding. In the number of experiments tried in New York City, in the past ten years, there has always been a difference of opinion as to the results obtained by the exponents of the different articulators. This difference of opinion existed between the best prosthetic and orthodontic minds in our city. As I stated before, the most important factor is mounting the casts upon the articulator with the facebow, and when this is done, the casts should be compared with the patient's mouth to see whether there is the same movement on the articulator, as there is in the mouth.

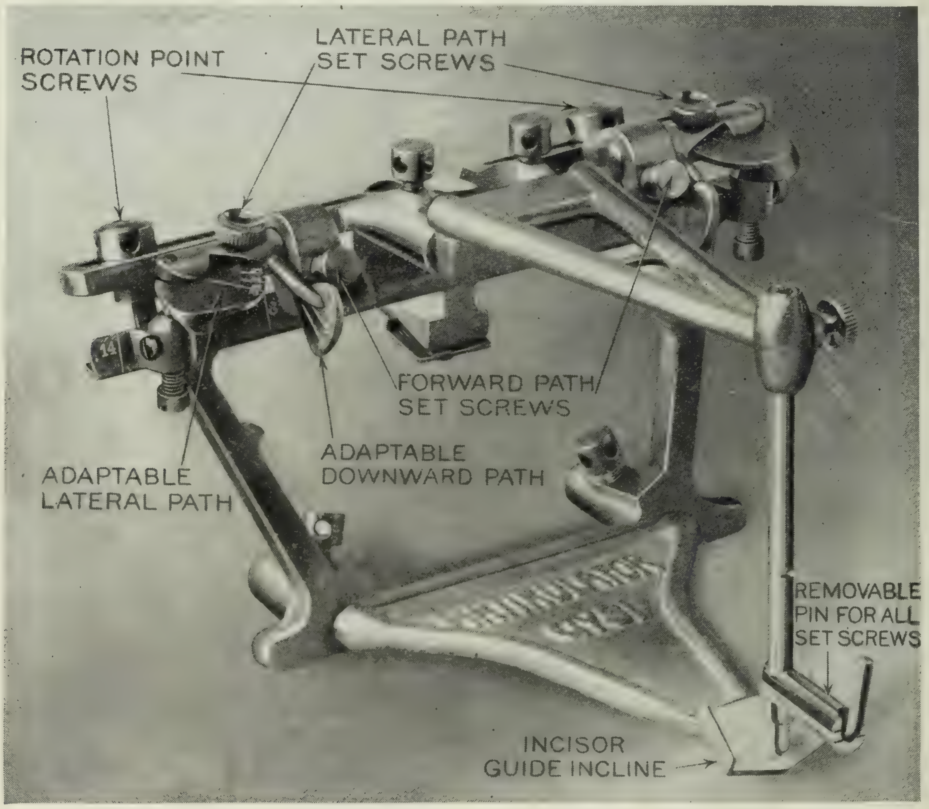


Fig. 156A.—Gysi Adaptable Articulator.

The greater the number of teeth to be supplied by an artificial denture, the greater the need for an efficient anatomical articulator. If we have two Class I cases mounted on an articulator, we should make bite plates, carefully record central occlusion, make our facebow registrations and mount the casts upon the articulator.

If the bite is not to be opened, this can be done on almost any articulator; the Stephan (Fig. 153), Gysi Simplex (Fig. 154), or the

Grittman (Fig. 155), all give excellent results. If the bite is to be opened, we introduce other elements of movement, and we must consider carefully the articulator to use. I personally have tried the Gysi Adaptable, (Fig. 156A), the Hanau Model II, (Fig. 157), the Wadsworth, (Fig. 158), the Snow Acme, (Fig. 159) and the Monson, (Fig. 160), articulators; also the Hanau Kinescope, (Fig. 161).

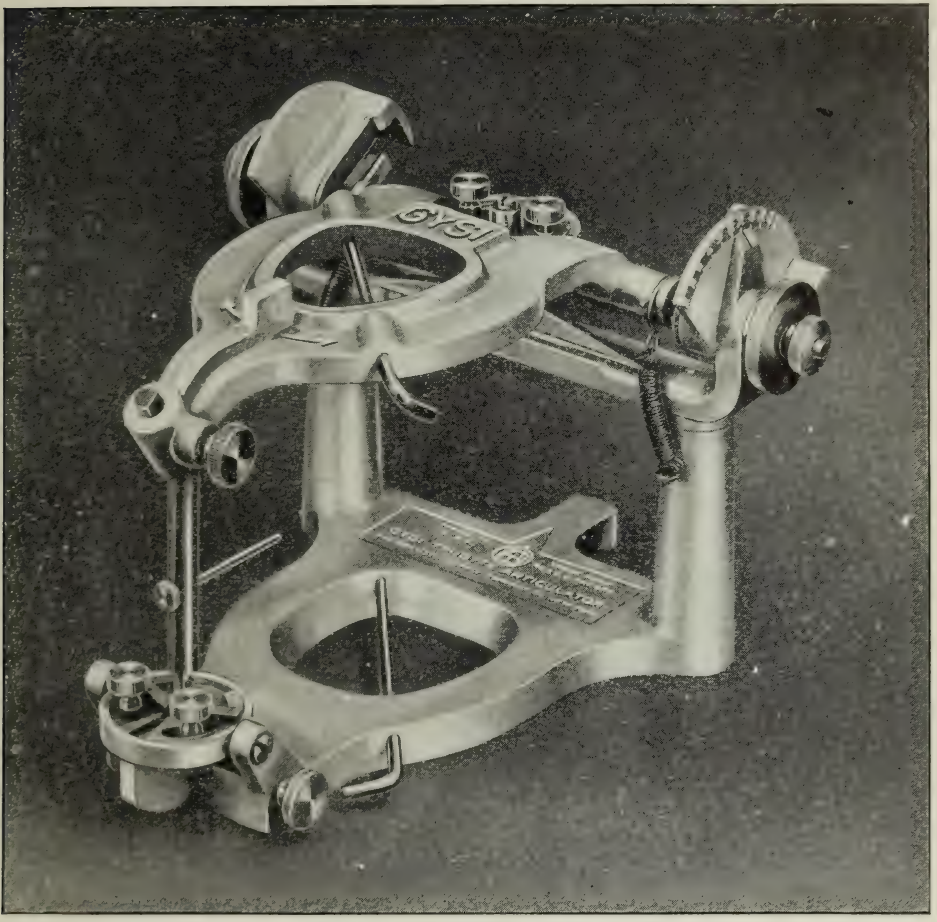


Fig. 156B. Gysi Trubyte Articulator.

I have used the Gysi Trubyte articulator (Fig. 156B) on four cases with remarkably good results. Two of these were partial cases, the others were bite raising cases of orthodontists. One of the great advantages of this articulator over others of the same type is that it can be set for both the protrusive and the lateral bites. It is not necessary to reset it each time to test these bites.

I think that they all give more or less good results, but with none of these articulators can the bites be taken together with the check bites, and the case finished without final adjustments in the mouth.

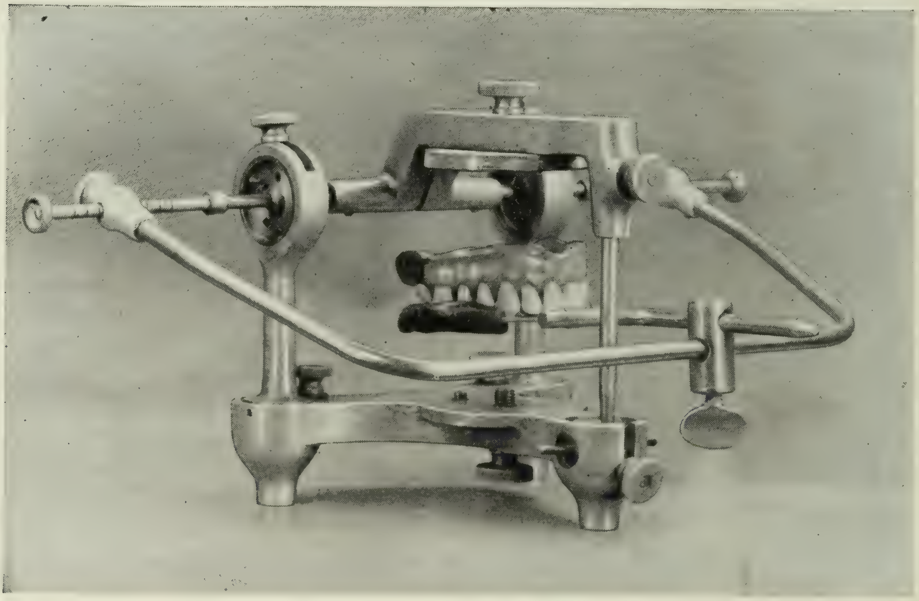


Fig. 157—Hanau Model H. Articulator.

In cases where we must open the bite I have found the Monson articulator very useful, especially in mounting our cases and diagnosing them, because it has the means of allowing us to build up an ideal curve, and it also has provision for shifting the bite to a new position, which is always necessary when we raise the bite.

The student would best select the articulator which he intends to work with and master the technique as described by the designer of that particular articulator.

After the casts are mounted on the articulator in central occlusion, the bite plates should be trimmed to allow the articulator to move in any direction and maintain contact over the surface of the bite plates. These should be placed in the patient's mouth, and the patient requested to make the same movements, that is, a protrusive motion of the mandible, then a right lateral, and then a left lateral movement. If the bite plates remain in contact in all of these movements then the articulator is functioning in the same manner as the jaw. If the

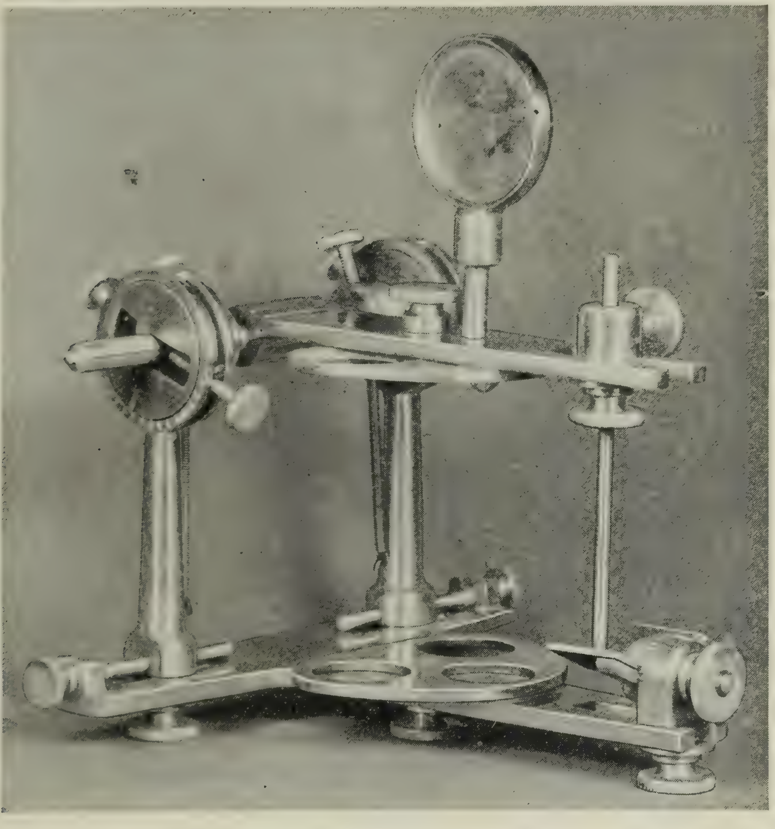


Fig. 158.—Wadsworth Articulator.

bite plates do not maintain contact, the rotating points and the condylar descents will need to be altered. This applies to the Hanau, Wadsworth, Gysi Adaptable, and the Snow Acme articulators, but not to the Monson articulator, as the Monson requires a different technique. If, as I said before, they do not maintain contact, small pieces of wax should be softened and placed in the spaces where the contact is lost, first getting the patient to protrude the jaw, and at the same time to close the mouth until the anterior teeth come into contact, edge to edge. This will compress the wax rolls which have been placed upon the bite plates, forcing the bite plates into place and giving the relationship in the protrusive bite. The locks on the articulator are loosened, that is, those that control the descent of the condyle and the bite plates placed upon the casts in the new relationship.

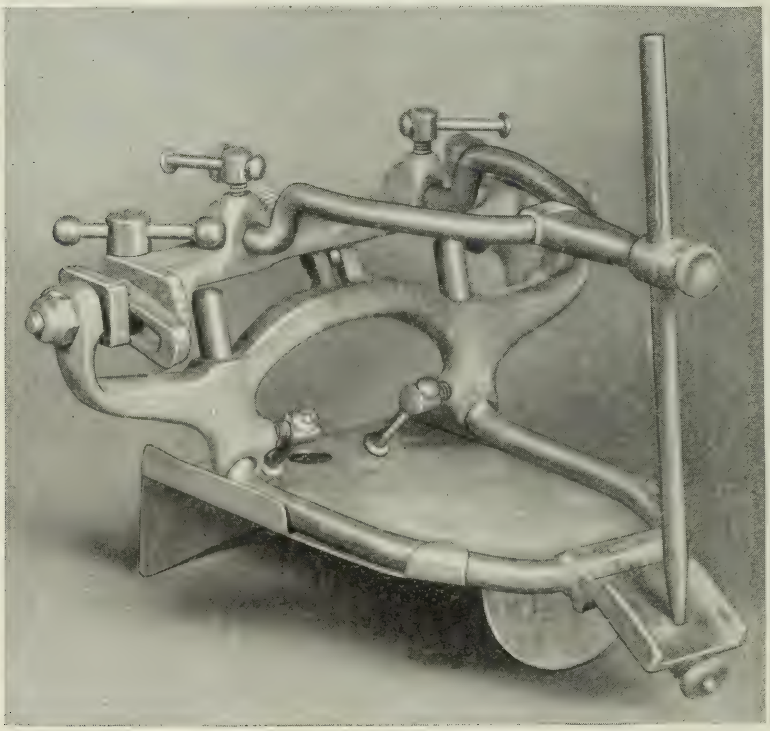


Fig. 159—Snow Acme Articulator.

It will be seen that the slots on the condyles form a different angle of descent. They are locked and the bite plates retrimmed to this new relationship.

This retrimming of the bite plate is essential, as it is the only check we have. When the bite plates are retrimmed, they are returned to the mouth, and if the articulator is accurate, the bite plates should glide over one another with this protrusive motion and maintain contact. The same thing can be done with the right lateral bite and the left lateral bite.

In my own practice I do not do this. I merely obtain the protrusive bite, set the teeth up to this bite and make the lateral adjustments in the mouth, because I have found that on the adaptable articulator it is impossible to make both of the protrusive descents of the condyles correspond to the lateral descents. In other words we are compelled to adjust the articulator's condyle descents for each different bite. This is too complicated a procedure, and just as good results can be obtained by simply getting the protrusive bite and setting the teeth up to that. Then the dentures are tried in the mouth, the teeth are adjusted to the lateral bite directly in the mouth. It simply means a small amount of grinding on the tooth surfaces, or tipping the teeth in the wax, bucco-lingually.

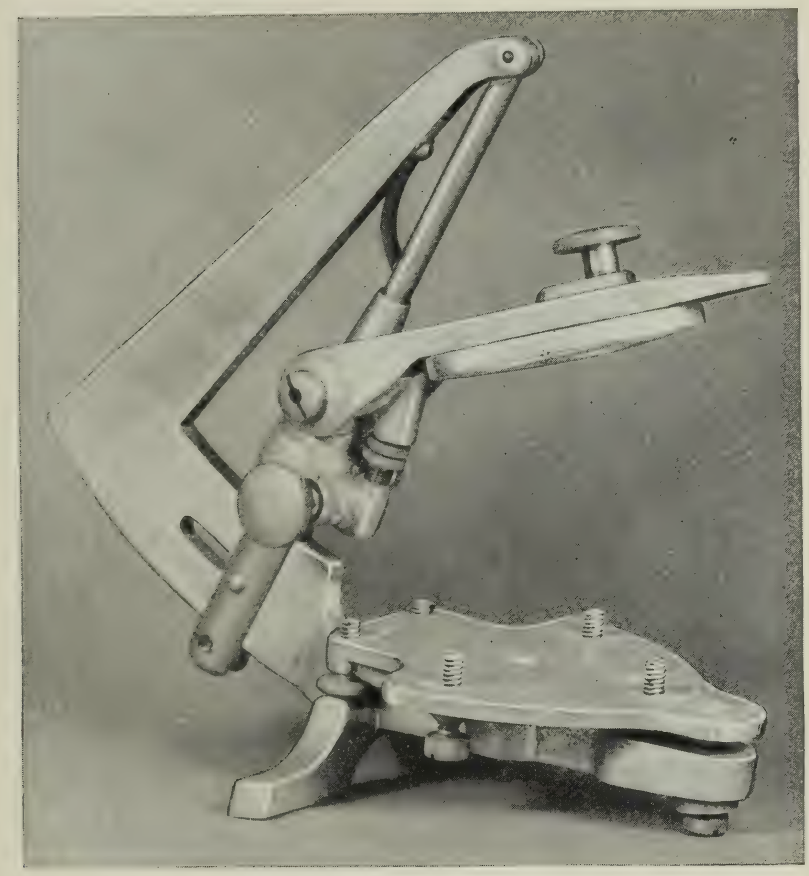


Fig. 160—Monson Articulator.

It is my practice where constructing two dentures in the same mouth, to finish one of the dentures first, take a new bite, mount it upon the articulator and reset the teeth of the denture which has been held in the wax. The rule I follow is to finish that denture first which has the least number of teeth upon it, as this requires less adjustment. If I have a full upper and a partial lower case, I make the partial lower first. If I have a Class I, upper, occluding with a Class III, lower, I make the Class III, lower first. This method of finishing one case at a time very often saves our making over both cases, if we have taken a wrong bite.

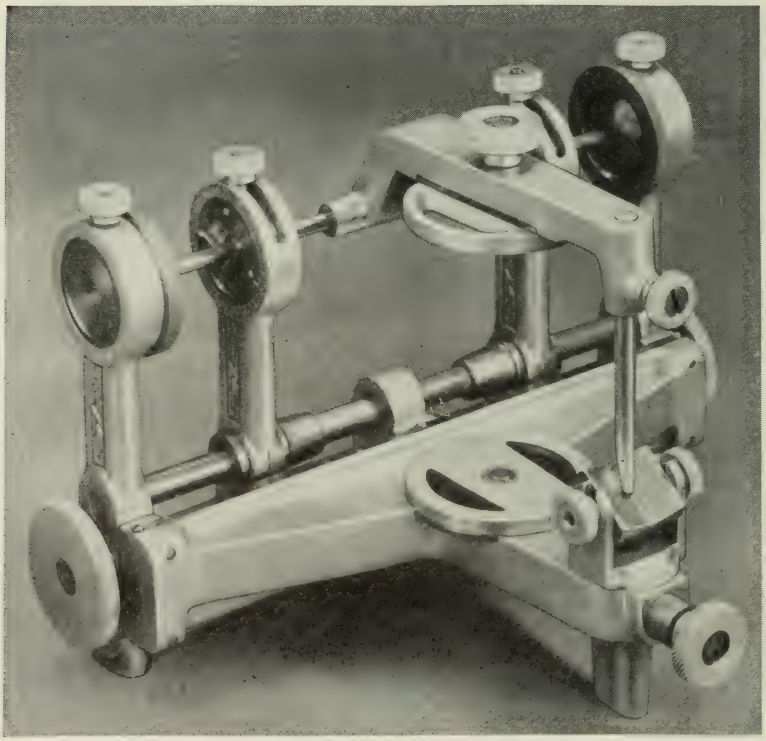


Fig. 161—Hanau Kinescope.

In mounting the case back on the articulator, the best method is to return to our original bite plates, place the finished case in the mouth and have the patient bite into the bite plate to obtain central occlusion. Then, when the natural teeth come in contact, soft pink wax, or yellow beeswax, is placed upon the bite plates and the patient requested to close. This gives us an impression of the natural teeth. The finished plate is taken from the mouth and placed in this impression. The bite plate is then placed upon its cast, and as we have mounted this cast with the facebow, the facebow registration is not lost. The bite plate is secured to the cast, the finished plate is waxed securely, and I find it is a great saving of time to wax the finished plate with boxing wax, and pour it with impression plaster, at the same time closing the articulator and attaching this to the frame of the articulator. I use impression plaster because we are not so liable to have accidents when we attempt to remove the finished plate from it, as it fractures more readily than cast plaster. It also sets more rapidly, and if the patient is waiting to have the final adjustments made, we save their time. When the plaster is sufficiently hard to separate, tear off the boxing wax, remove the bite plate and place the plate which has been left in the wax upon its cast, and rearticulate. We can do any grinding required at this stage to obtain a good occlusion, and when we are satisfied with the bite, we can try it in the mouth.

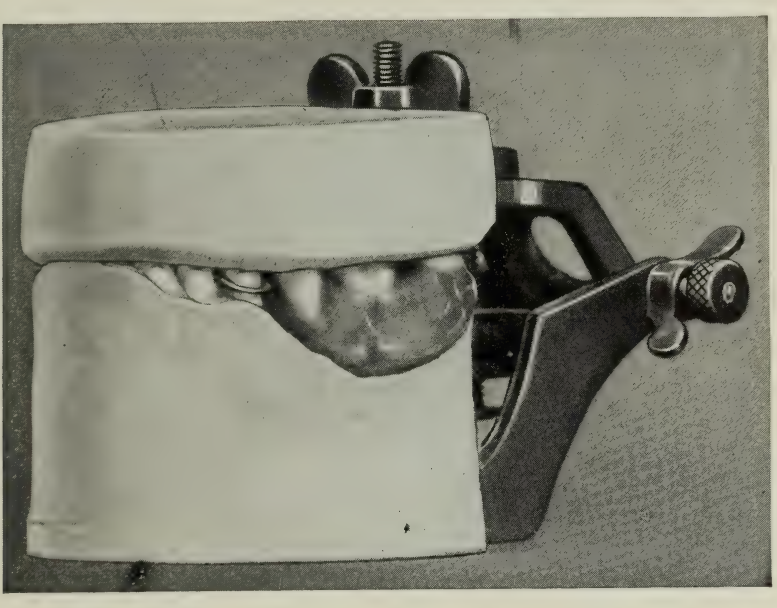


Fig. 162—Edward Handler "Fool-Proof" Articulator.

We should be careful in removing the finished plate from the articulator as we can readily bend, or break it. Be careful about trimming away any bits of plaster which may have run over the edges of the plate when we poured the cast. This is especially true around clasps. If we note any marked undercuts on the ridges when we mount the finished plate, it would be a good idea to fill these with wet tissue paper or moldine, so that when we come to remove it from the cast we do not have it adhere too tightly, and we thus obviate the danger of breaking the plate.

There are some cases, due to the irregularity of the natural teeth remaining, or due to the fact that few teeth are to be placed upon the denture, where it is not advisable to use an anatomical articulator. The ordinary plane line articulator with a pin connecting the upper and the lower jaw is inaccurate, but I have found that the articulator manufactured by Edward Handler, (Fig. 162) known as the "Foolproof" articulator, which has no pins holding it together, but is tightened by means of a pointed set screw with a lock-nut, is the best to use for these cases. It has a further advantage in that the set screw can be loosened slightly and a small range of movement obtained. Dentures made in this manner should not be ground to occlude too closely, but should be tried in and the final occlusion perfected by spot grinding in the mouth.

CHAPTER X

Bite Raising and Correlating Occlusion

Bite Raising and Correlating Occlusion.

While writing on the subject of taking the bite, if something were not said about raising the bite and correlating occlusion, the subject would be incomplete. The writer has positive views upon this subject, and mainly because the problem has presented itself in his own mouth. He has consulted with a number of prosthodontists and orthodontists, but it was not until he met Dr. Monson in Milwaukee that he could find anything in dental literature, or in the clinics that indicated the way out. While I do not agree with all of Dr Monson's theories, he has shown the dental profession that "balanced occlusion" (the term functional occlusion seems preferable) is of the utmost importance, and he has brought to the dental profession, and interpreted, the work of Prentiss.

I do not wish to be misunderstood. I have no "isms" and favor no one manufacturer of anatomical articulators, but I can safely say that after experimenting with almost every type of anatomical articulator for these raised bite cases, the Monson instrument best enables us to diagnose our cases before we start work. I wish it to be distinctly understood, that I am confining my remarks to partial cases. I have had some success with the Wadsworth articulator, and while I have never used the McCullom instrument, I have seen it demonstrated and I believe it could also be successfully used.

Advantages of the Monson Articulator.

The Monson articulator has a number of advantages in bite opening cases. It has rather a free movement which allows the cusps of the teeth to act as guides for the condylar movement. It has a point from which we can measure to determine whether the cusps of the teeth are above, or below the plane of occlusion. It has a method of readjusting the articulator so that the mandibular cast can be rearranged anteriorly and posteriorly without taking the cast off the articulator; and it has an adjustable plate, supporting the lower cast, which allows us to overcome any slight errors of bite taking when we are correlating the occlusion, or raising the bite. No doubt attachments could be placed upon the other articulators, which would allow us to do these things, but this has not been done, simply because their designers have not recognized the fundamental principles of opening the bite.

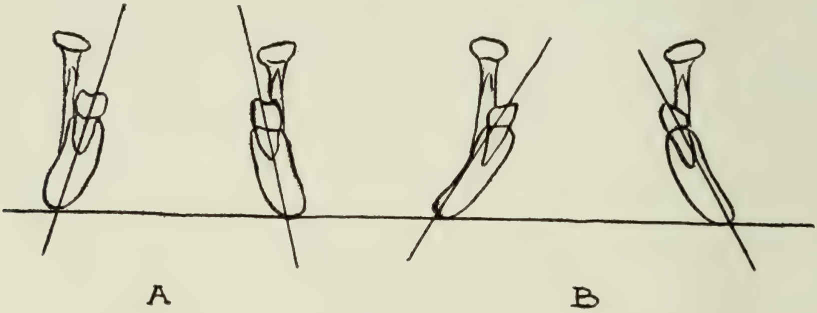


Fig. 163. Drawing showing sections through the mandible. A. Normal occlusion. B. A case of attrition with resultant tipping of the mandible.

These principles are two: first, when the bite is opened after the teeth have been worn down, or displaced by malocclusions, the mandible assumes a new position and the heads of the condyles change their relations to the socket of the temporomandibular joint; and second, when we have wearing of the teeth, or malocclusions, the bone of the mandible actually changes shape. This is pointed out by Prentiss and is known in the medical literature as "Wolff's Law."

This is readily demonstrated if we examine skulls where the individual had been suffering from malocclusion, or attrition. The bodies of the mandible are twisted away from one another and the heads of the condyles are so turned as not to fit their sockets. This can be more readily seen in unilateral cases where attrition has occurred on only one side of the mouth. (Fig. 163.) One side of the mandible will be distorted while the other side may remain nearly normal.

I would like to point out the change that takes place in the angle of the mandible, and this fact, I believe, is not mentioned in any dental literature. This change is due more to the loss of structure of the bone than to alteration of the angle of the body of the mandible and the ramus. (Fig. 164.)

There are many illustrations showing the change in the angle of the mandible, but the writer believes this is mainly an optical illusion, and

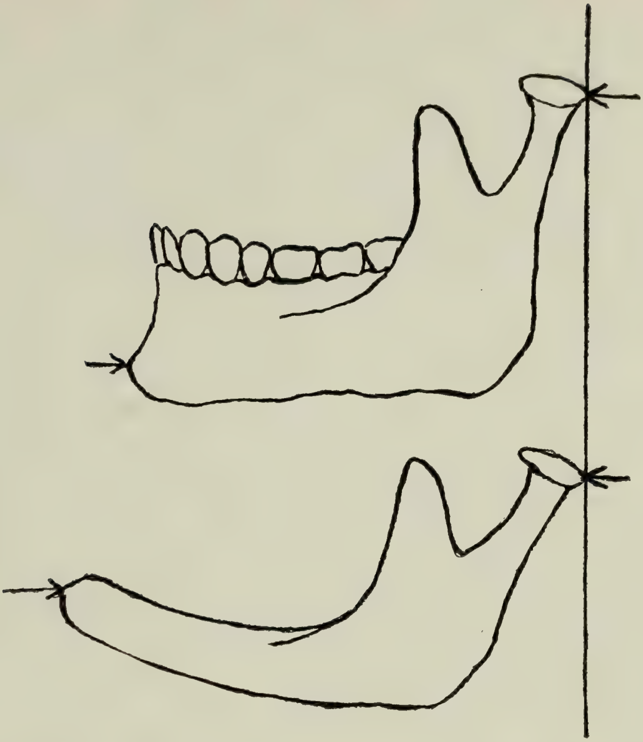


Fig. 164. Shows edentulous mandible apparently longer than the one with the teeth. The distances between the arrows pointing to the same spots are the same.

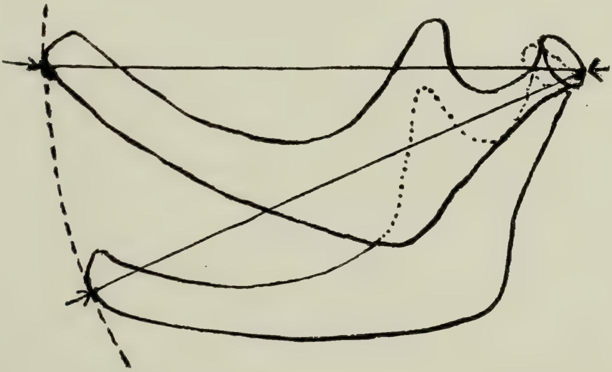


Fig. 165. Shows how the mandible moving on the arc of a circle allows the symphysis to come forward.

the reason why the symphysis is further forward in edentulous cases, or cases where the teeth are worn down, is because the bite is closed up and the chin swings forward in an arc of a circle. (Fig. 165.)

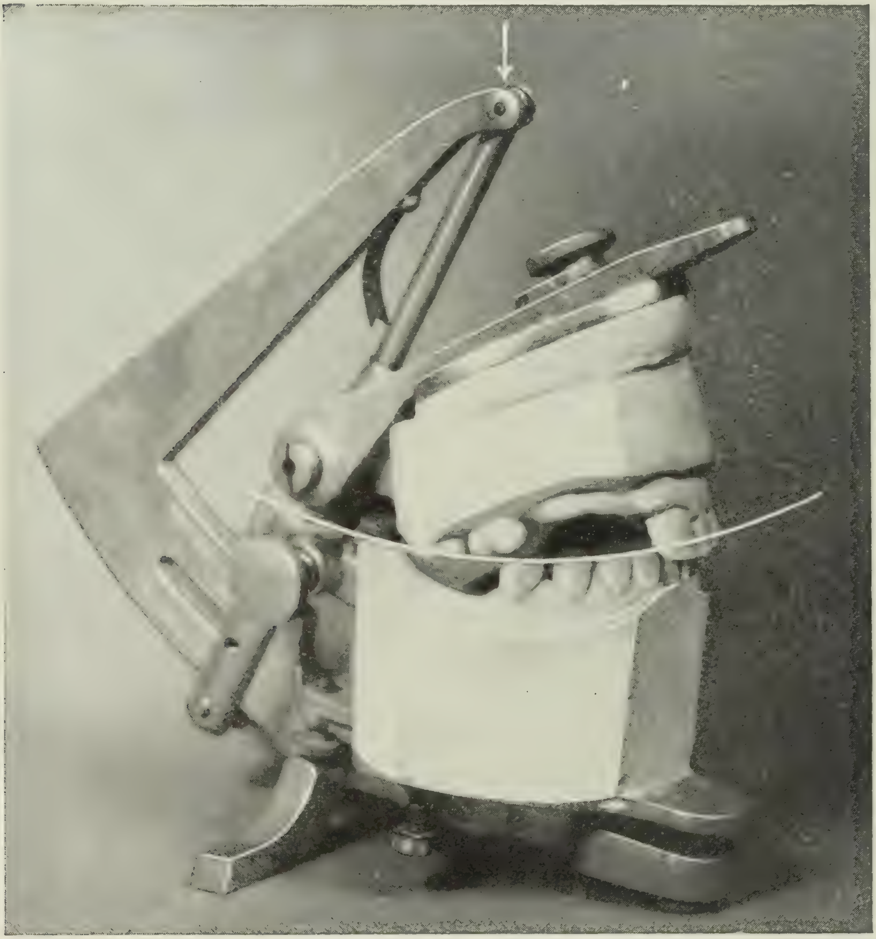


Fig. 166A. Closed bite case mounted on a Monson articulator for diagnostic purposes. Arc of the circle drawn on the lower teeth. Arrow indicates center of the diameter of the arc.

If we plan to open the bite, we should come as near to the ideal as possible, and the spherical theory of Dr. Monson offers us a step toward that ideal. I do not believe that the mandible moves on a perfect sphere, but, in the ranges of our work, the mandible can be made to conform to the surface of a sphere as easily as to some other shape. While I believe that the surface discussed is more the shape of an egg, or a combination of two spheres, one for the posterior teeth and one for the anterior teeth, yet, if we build up our lower teeth so that the points of the cusps conform to the surface of a sphere, as pointed out by Dr. Mon-

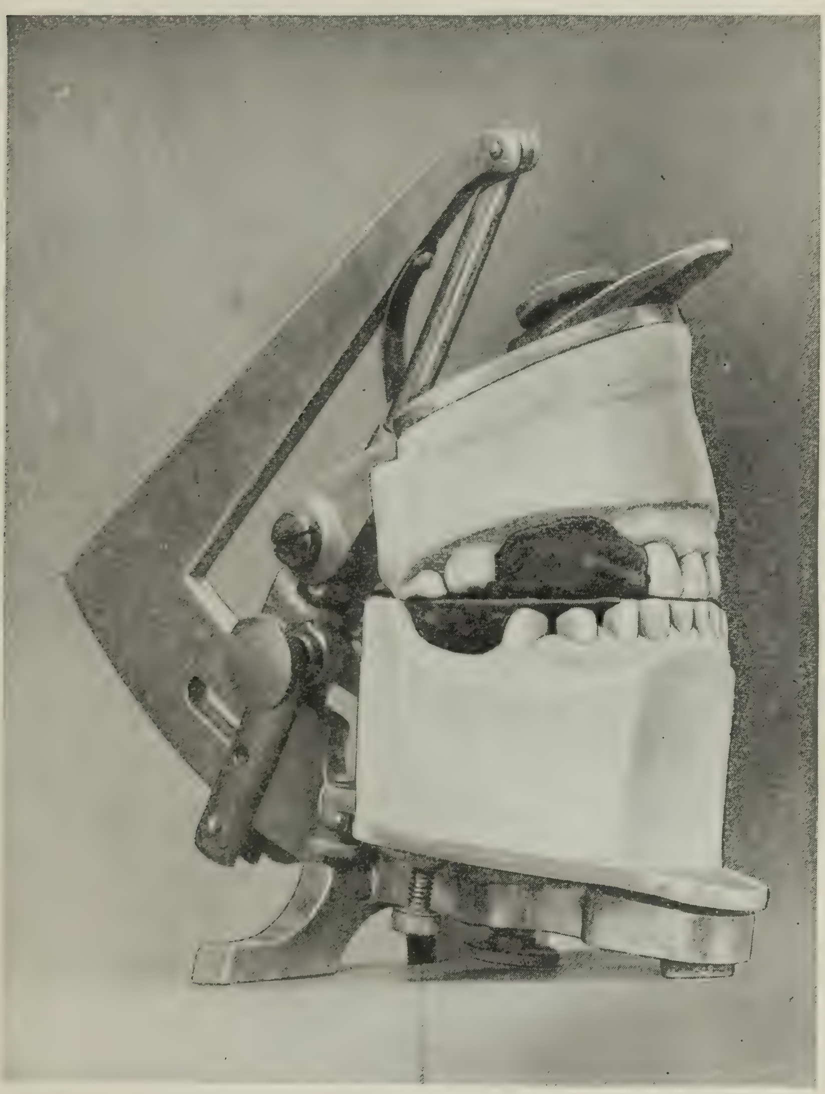


Fig. 166B. Same case with block bite built up, on right side.

son, we can alter the height of the cusps and the depths of the sulci of the posterior teeth and the length of the overbite and the over-jet of the anterior teeth so as to bring the teeth into functional occlusion.

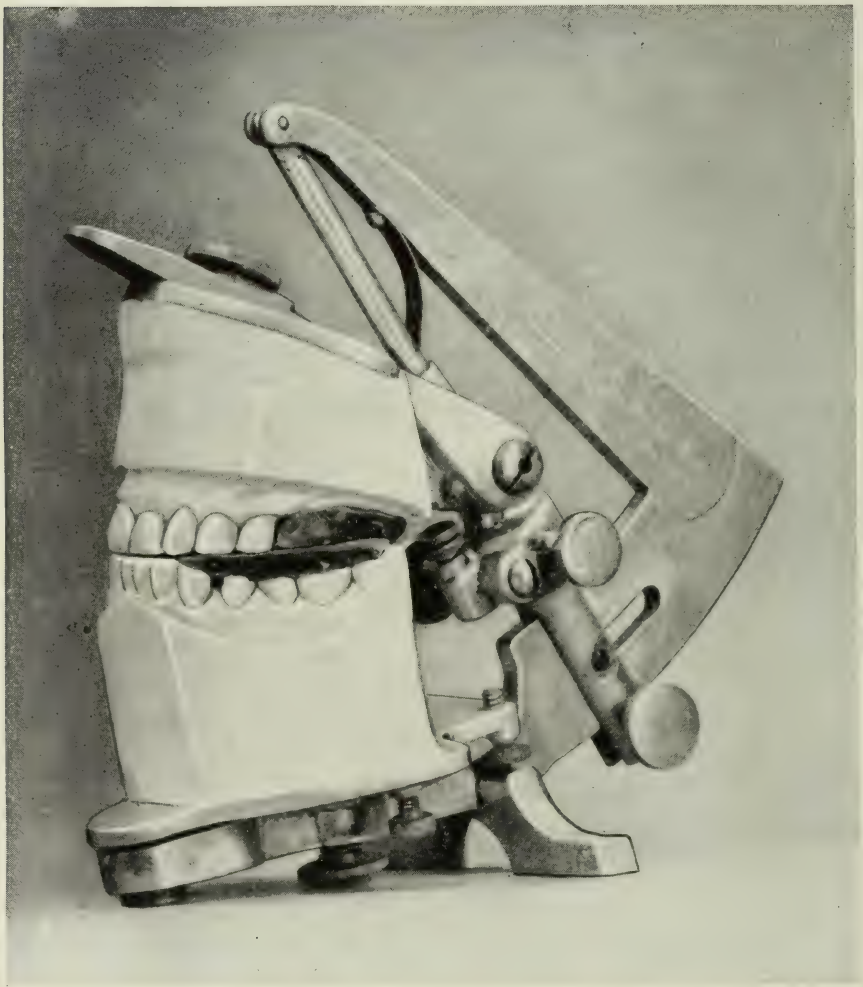


Fig. 166C. Same case, showing left side.

I hope that I have been able in this small space to make my position clear, and I also hope that some one will invent an anatomical articulator which will allow us to reproduce the motions of the mandible exactly as they are found in each individual case, and which will be so adjustable as to allow it to conform to the changes which occur when dentures or bridges are placed in the mouth, which are intended to put the teeth in functional occlusion.

Technique in Opening the Bite.

The best procedure in bite opening cases, is to obtain two very accurate study models and the face bow registrations, using one of the face bow attachments which is best suited for the case. In mounting this case in the articulator I deviate slightly from the Monson technique. After placing the face bow on the articulator, I measure the distance between the median line and the cutting edges of the incisal teeth to the ends of the little bars which represent the center of the condyles. In the great majority of these cases the distance will be equal, that is about four and a quarter inches. If it is unequal, say four inches on one side and four and a quarter on the other, I take the mean distance and set my calipers for four and an eighth inches, and I use this to measure the distance from the mark at the top of the instrument to the incisal edges of the teeth to the center line.

I believe Dr. Monson always uses the four-inch distance. Of course this would vary with different people, and if you are working on the principle of an equilateral triangle, it is better to work on the size of the triangle which fits the case, rather than one which is an average. I do not believe that we find the equilateral triangle in the patient's mouth, but if we are attempting to build up an ideal occlusion, and hope that the mandible will conform to it, the equilateral triangle will be as good as any other.

We must decide at this time whether we care to follow the school which hopes to bring back an ideal occlusion, or the school that does not believe that the mandible will conform to the changes, or that the ideal occlusion can ever be established. I prefer to follow the first school, that is, in the partial cases. I do not believe, however, that in full edentulous cases, the jaw can be made to change its shape. After the study models are mounted on the articulator, the capilers can be set to the height of one tooth in the lower which appears to be in its normal position, and then markings are made on the other teeth which are above the line of occlusion, and wax built up on those which are below the line, determining how high it is necessary to raise them to bring them into functional occlusion. Any edentulous spaces are filled in with wax blocks, and they are trimmed off to conform to the height of the calipers.

The same thing is done in the upper and it is then determined whether we think it is practical to cut down, or to build up the teeth in question. Sometimes a tooth is extruded too far to allow it to be cut down, without devitilization and it may be more advisable to extract it.

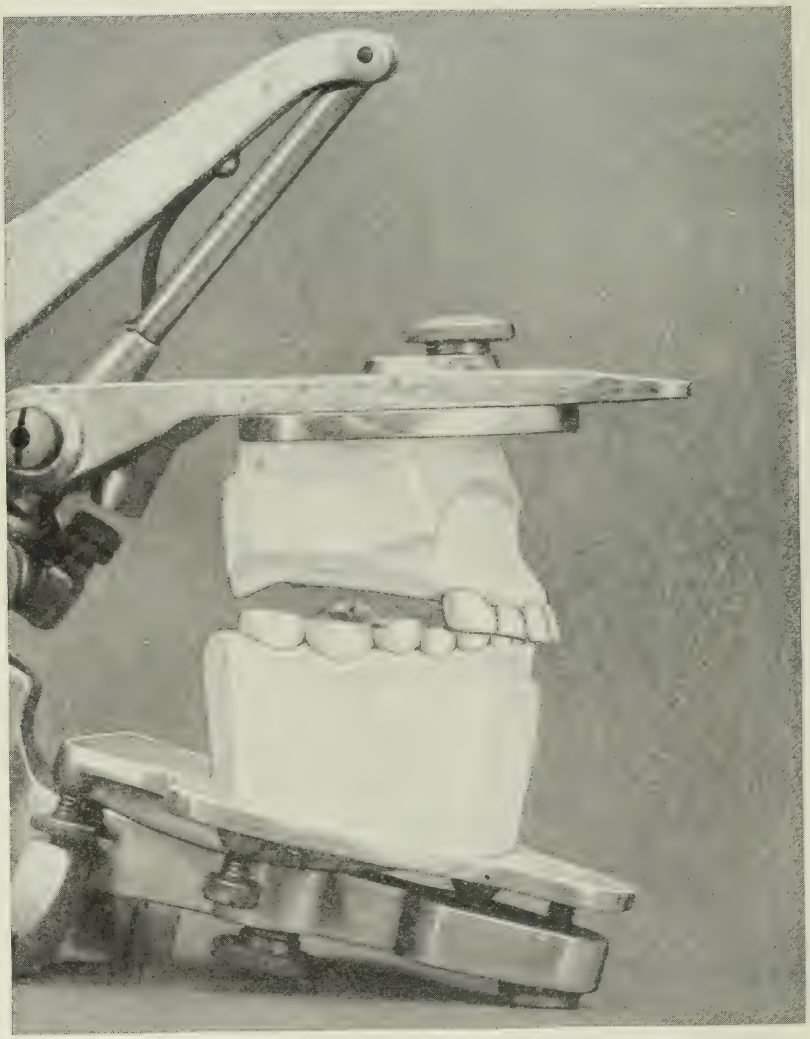


Fig. 167A. A Class I case, with all the lower teeth in place, but shortened by extensive attrition. Anterior teeth down to the gum margin.

The advantage of doing this with the study models is that this allows us to consult with our patient, and the wax blocks which were put on the teeth can be lifted out and placed in the mouth showing the patient the effect of the restoration, and at the same time the dentist can determine whether the work will be practical, and whether the mounting of his models on the articulator has been correctly done.

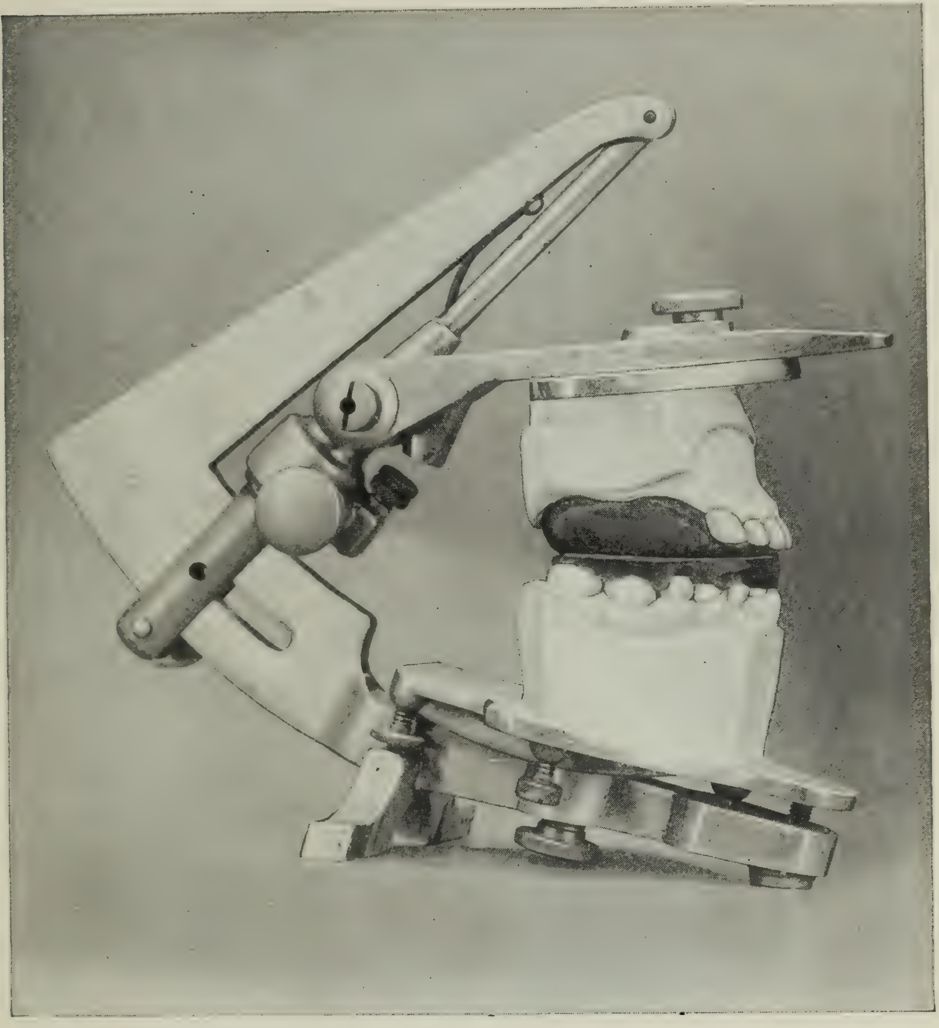


Fig. 167B. Bite opened and bite blocks built up on study models.

The shaping of the wax is greatly assisted if the student obtains a small plate known as the "balanced occlusion guide" (B. O. G.) or "bite rim former." This is a piece of German silver or brass, swaged at a radius of four inches, and gives us the correct curvature of the wax without the necessity of carving and measuring with the calipers. This "balanced occlusion guide" can be obtained from any of the dental supply companies. If, however, you have a single tooth which is above the occlusal line, that will need to be cut off, or the plate will not go to its proper position.

When it has been determined that we are to proceed with the case, it is best to make the bite plate base of vulcanite, and build up the bite rims with some hard substance, like modeling compound, or shellac. If any of the teeth are to be cut off and crowned, or inlaid, the preparation can be made for it and the bite plates placed in the mouth, and then we can determine the height necessary to build the crown or inlay. It is here that the "balanced occlusion guide" is useful, allowing us to shape the occlusal plane by placing it on the upper or the lower bite plate after the wax has been warmed sufficiently to allow it to be pressed by the plate to the proper curve.

It is best to work on one jaw at a time, either the mandible or the maxillæ. I prefer the mandible because it is easier to determine whether we have the teeth built up to the proper height. This can be done by setting our calipers to the distance of the height of the cusps of the teeth from the guide point on the top of the articulator, selecting teeth which are not to be cut down or built up, and seeing that our restored teeth conform to their height.

The crown can be constructed, likewise the inlays placed in position and our impression taken, the casts poured and mounted on the articulator. If you have a sufficiently accurate study model to occlude it with, it will not be necessary to reset it with a facebow as the original registration, if carefully taken, will prove sufficient. I prefer not to cement the crowns and inlays in the mouth, but to take my impression with them in place; then, when we are ready to pour the impression, these crowns and inlays are placed in position and the cast poured upon them. It is also better, in case of an inlay, to take the impression without the inlay in the cavity, that is, if we are using the indirect method of making the inlays, and when we come to pour our cast, the die upon which the inlay was constructed can be placed in position in the impression and the cast poured about it.

It is sometimes best not to build our inlays or our crowns completely, but wait until we have our final casts made and mounted on the articulator. Finish the whole structure and place it in the mouth, then the patient is much more comfortable than if we allow him to go with just one or two teeth built up while we are completing the rest of the work.

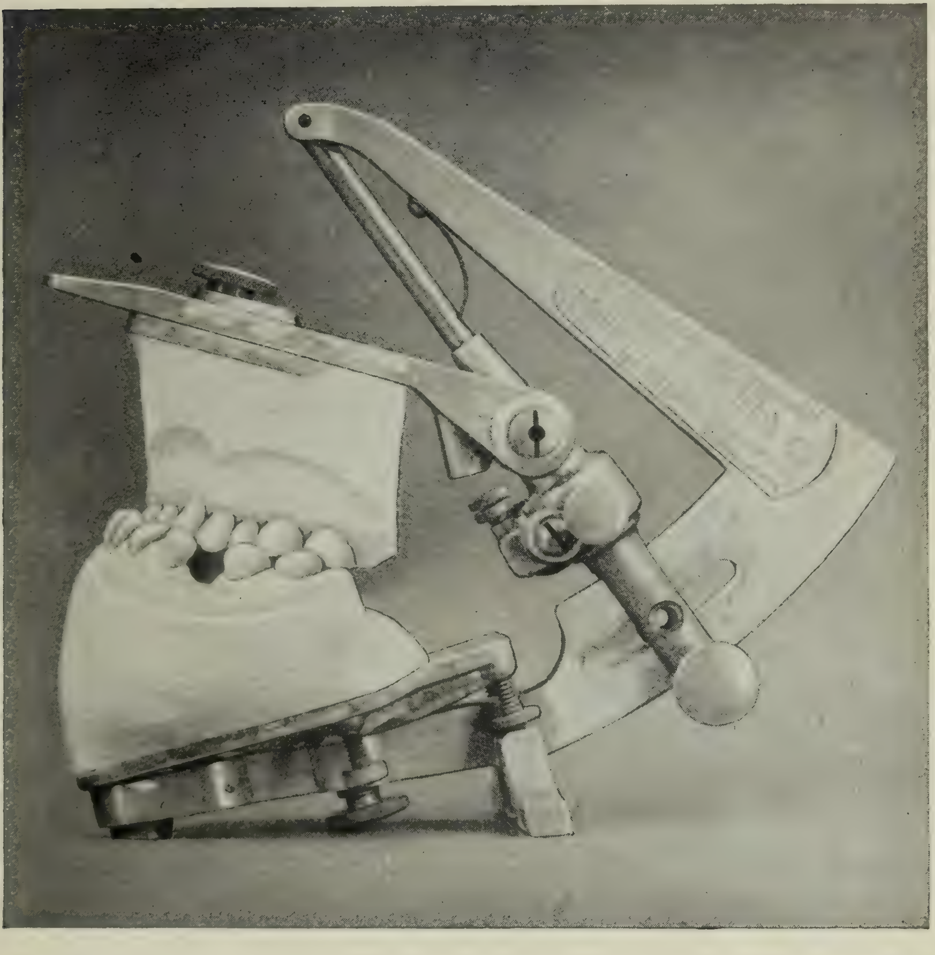


Fig. 168A. A case of Class III, Angle classification. Patient fifty years of age. Casts mounted on a Monson articulator for diagnostic purposes.

If, however, we have to build up the bite partially, it is always best to select teeth on opposite sides of the mouth and build up these, as the patient is much more comfortable if on both sides of the mouth he has rests to bite against.

When we have finished the lower work we then proceed with the upper. The abutments are prepared, the impression taken and the bite made in relation to the lower. If we have destroyed our casts of the lower, a new facebow bite at this time will be necessary and it makes

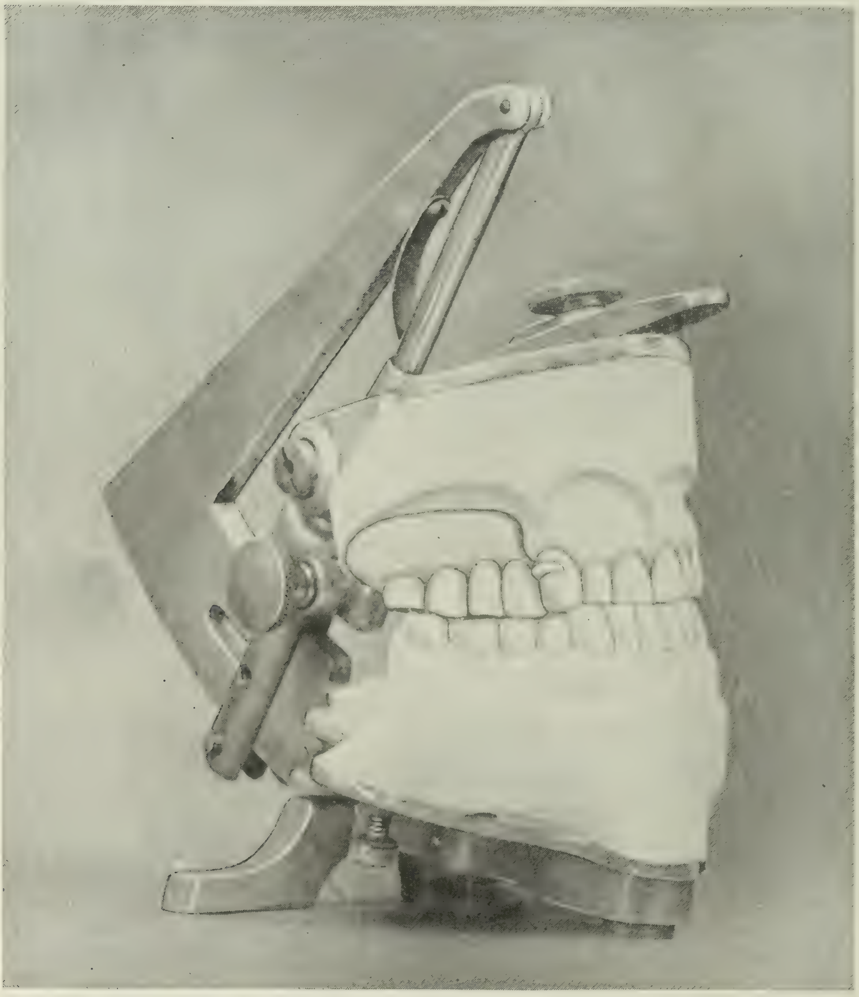


Fig. 168B. Right side of case, with dentures in place.

no material difference as to what articulator we mount it upon now, for we have our ideal curve built up. I have at times started with a Monson articulator and finished the upper case either with a Wadsworth or a Hanau, by using the check bite method to do my final grinding in.

I would advise no one to attempt the opening of the bite without first familiarizing himself with the Monson technique, and likewise wherever possible, to build up temporary bite raisers in vulcanite or gold to determine just what change will take place in the jaw. This change always occurs and I cannot understand why it was not recognized, or at least not written about by some one before Monson.

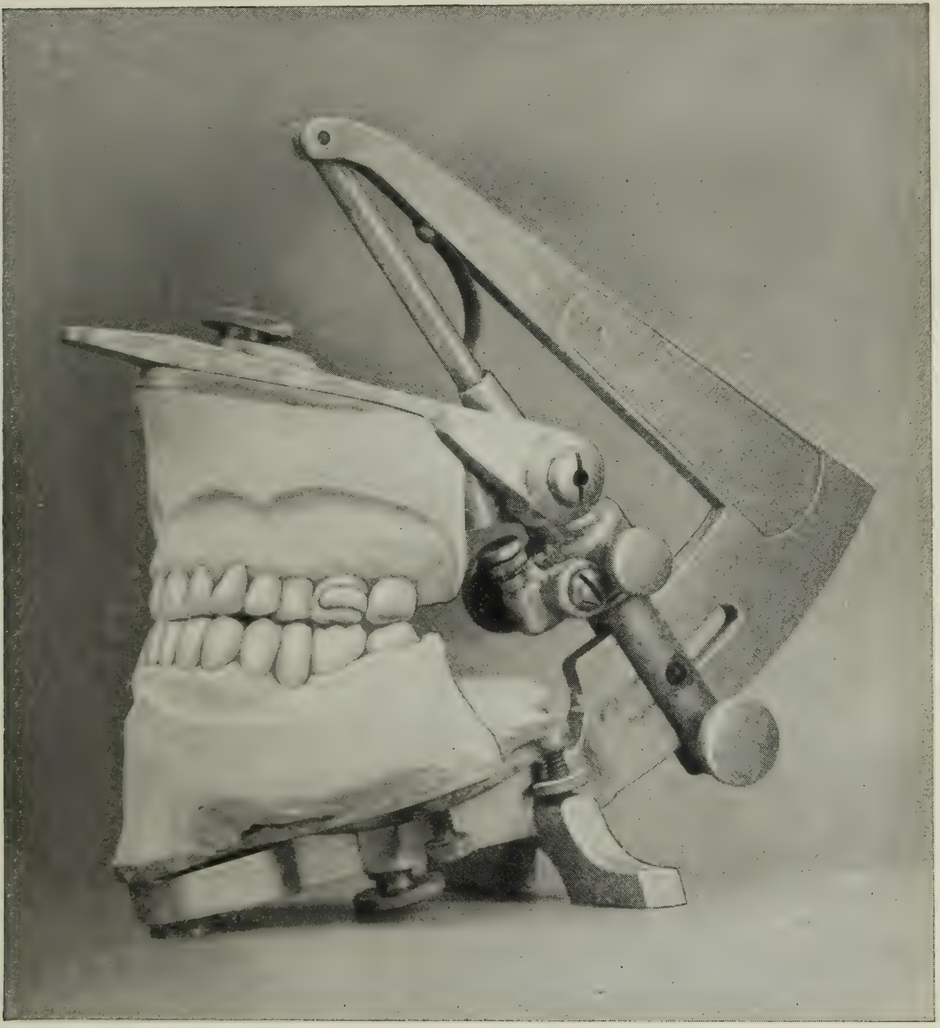


Fig. 168B. Left side of case. This patient wore the temporary bite raisers for two years before permanent bridge and plate work was supplied.

Dr. Monson points out that the mandible comes forward, which is very true in cases which have badly worn occlusion, but in Class III (Angle) cases, the mandible goes backward, and if the bite is built up with temporary appliances made of gold or vulcanite, or with teeth upon them, the mandible will assume its new position in time. In constructing these appliances the cusps must be kept rather flat and the overbite must not be deep enough to prevent the mandible from assuming a new position.

In one of the cases illustrated, Fig. 168B, the patient wore the bite raisers for two years before the final work was done upon the mouth. In all cases the bite raisers, of vulcanite or of gold as may be required, should be worn until the operator is convinced that the patient's jaw muscles will tolerate the more open position of the natural arches. Usually such period would be from four to six months.

CHAPTER XI

Designs of Saddles and Indirect Retention

The writer considers this chapter second only in importance to the chapters on impression taking. The student who masters impression taking, but fails to grasp the importance of the designing of dentures, will have many failures in his work. Many men take excellent impressions and make beautiful pieces of work which fail, because the wrong kind of attachments are used, wrong teeth selected to clasp, or because the saddles are improperly designed.

One of the most important details of technique is saddle design. Next is the subject of indirect retention, and it is hardly possible to separate the two. The subject of clasps can be treated separately but it has intimate relation to the designing of saddles.

Dr. Cummer has advanced the idea of indirect retention, and I believe has revolutionized the designing of partial dentures. Indirect retention gives us stability of the plate portion of the denture, without regard to correlation of the occlusion. The best correlation of the occlusion will have no effect if the base upon which the teeth are set does not have inherent stability. This stability must be gained, first, by the proper method of taking impressions as described in Chapter IV, with the object of preventing side to side rocking, when the mandible is in lateral excursions. Secondly, indirect retention is used mainly to prevent the forward and backward rocking of the denture.

To describe indirect retention it is best to take a Class I lower case where the bicuspids are present and see what happens when we have constructed a lingual bar lower denture. Measuring from the front of the bar to the posterior edge of the plate, the clasps are approximately in the center of the denture, and any force applied to the end of the saddles will cause the denture to begin rotating about the clasps. Nothing can prevent the saddles from dropping to the extent of the compressibility of the tissues, when stress is applied to them, but when this force is released, the muscular attachments around the edges of the saddles will cause the plate to rise from the ridges, the bar in the front will dip downwards, and if it is close to the tissue will irritate it.

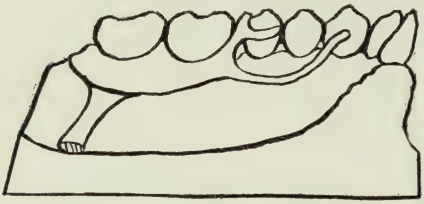


Fig. 169.

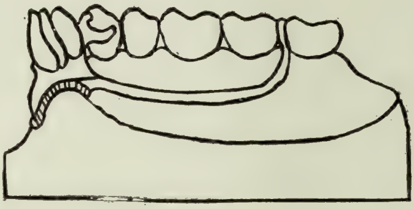


Fig. 170.

Fig. 169. Class I, upper, case. Cummer method of indirect retention with extension arm resting on the cuspid tooth. This is a view of one-half of the denture.

Fig. 170. Class IV, upper, case. Cummer method of retention. Extension arm resting between the second and the third molars.

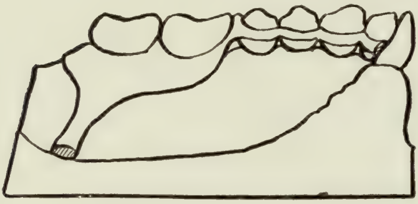


Fig. 171.

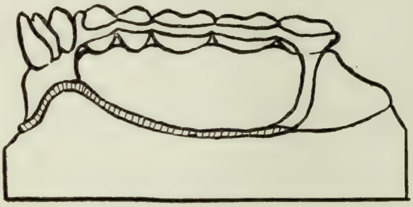


Fig. 172.

Fig. 171. Class I, upper, case, as designed by the author, with continuous bar running back of the anterior teeth and acting as an indirect retainer. This shows one-half of the denture.

Fig. 172. Class IV, upper, case, as designed by the author. Continuous bar acts as an indirect retainer.

If the clasps hold tightly, the teeth to which they are attached take these strains, and in time loosen. Dr. Cummer, by a very brilliant idea, ran a finger forward, resting it against one or two teeth, anterior to the clasps. (Fig. 169.) He uses preferably the cuspid in the mandible, and a cuspid or a central incisor in the maxillæ. This finger is adjusted in such a manner, that when the saddles are firmly resting upon the ridges, there is a slight pressure upon the teeth, which prevents a backward and forward rocking of the plate. This would absolutely prevent the movement of the saddles away from the ridge. Of course, it would not overcome the compressibility of the tissues but it does prevent the denture from rising from the ridge, and does prevent food from packing under it, and at the same time overcomes the tendency for flabby muscles at the edge of the saddles to be caught under them and be pinched. Attention is paid to the design of the clasp so that it can rotate around the tooth surfaces, using the lug as a fulcrum, and when a spring clasp is used, practically no stress is placed upon the clasped teeth. This was a brilliant idea and the only wonder is that the principle was not universally adopted. I am showing some illustrations upon this subject in Figs. 169 and 170 and Figs. 173, 174, 175 and 176, and they should be studied very carefully.

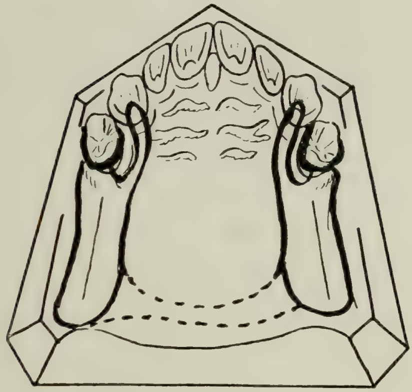


Fig. 173.

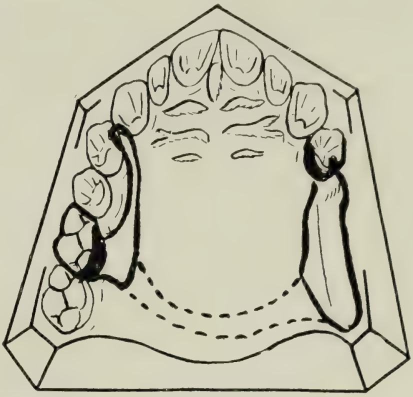


Fig. 174.

Fig. 173. A design for Class I, upper, case. Cummer method of indirect retention.

Fig. 174. Design for a Class II, upper, case, using Cummer method of indirect retention.

There are some objections to the use of these arms. The extension fingers are made of light material, and if they press too hard upon the teeth, they act as regulating appliances and move the teeth. Dr. Cummer assures me this does not occur in his practice, but I believe his skill is such, that he does not have them pressing too hard. However, in other men's hands this does sometimes occur. Again, the patients in cleaning them often bend them.

Dr. J. Wright Beach of Buffalo, conceived the idea of making these arms continuous, running from one side of the plate to the other, using fine wire to be readily bent around the contours of the teeth.

It has the added advantage of preventing a side to side motion of the plate, which to my mind is of more importance than preventing forward and backward motions, as the side to side motions loosen more teeth than the forward to backward.

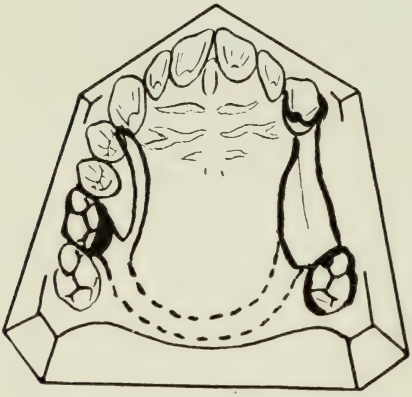


Fig. 175.

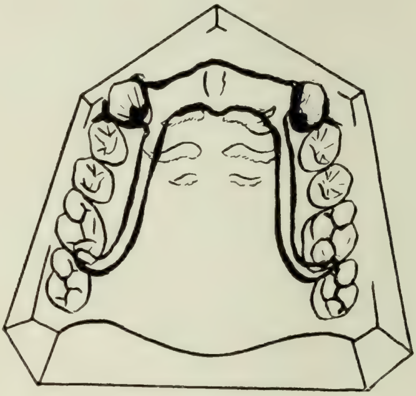


Fig. 176.

Fig. 175. Design for a Class III, upper, case, using Cummer method of indirect retention.

Fig. 176. Design for Class IV, upper, case, using Cummer method of indirect retention.

This use of a fine wire has a disadvantage the wire being easily bent by the patient and Dr. Woodworth, who was associated with Dr. Beach, brought out the idea of casting these wires and called them "continuous cast clasps." They are, however, nothing more nor less than indirect retainers. Dr. Cummer did not stop with the use of these in Class I cases, but in Class IV cases he ran them back, resting them upon molars and sometimes used small saddles behind the molars for the purpose of indirect retention. Likewise he uses them on Class II cases. (See Figs. 170, 173, 174, 175 and 176.)

They are not absolutely essential in Class III cases, because the lugs act in the same capacity. In Class I and its modifications both upper and lower, the teeth supplied in the anterior part of the mouth were attached to the bar, and the posterior saddles acted as an indirect retainer, provided small lugs were made extending out and touching the adjoining teeth. These had the disadvantage of moving the teeth on each side, if there were any amount of settling of the denture, and it was with the idea of preventing this that I used the continuous bar mentioned in Chapter I. This upper bar also distributes the strain from the attached teeth, to the other teeth which do not have attachments upon them, and in a great measure prevents settling of the denture. (Fig. 171.) I would advise no one to make continuous clasps by the casting process, as they are not sufficiently flexible to allow for the normal tooth movement, and they produce erosion on the teeth, just as the cast clasps do. These objections are entirely overcome when they are constructed of pure gold, using clasp wire soldered to it, to strengthen it, and using the minimum quantity of solder of a high karat which allows flexibility. (Fig. 172.)

With these ideas the designs of dentures were entirely altered, allowing us to make lighter dentures, with more of the surface of the palate exposed, which gives more comfort to the patient and changes the denture from a regulating appliance into a retaining appliance, preventing the individual teeth from moving out of their normal alignment.

Designs of Saddles and Bars.

In a Class I, upper case, if the indirect retainers are used it is not necessary to use the old fashioned plate to carry the teeth. This old fashioned plate had the disadvantage of settling and coming into contact with the gingival margins, constricting their blood supply, and pinching these delicate gum margins between the plate and teeth, which resulted in recessions of the gum, pyorrhea pockets and the ultimate loss of the tooth, or teeth thus injured. They did not allow the normal secretions of the mouth to wash away the fine food particles, and these, collecting at the gingival margin disintegrated the exposed cementum.

We are all familiar with these cases and in many instances teeth have been lost, due to the impossibility of filling them at these points without devitilization. The palatal bars of the continuous clasps absolutely prevent these pathologic conditions, if they are properly designed. I will give a number of cases with diagrams suggesting designs for these bars and saddles, with the hope that the student will modify them to suit his special cases after he has learned the principles involved.

Avoiding the Gingival Margins.

In designing saddles we should always try to keep from 1-32 of an inch to 1-16 of an inch away from the gingival margins. This has already been suggested in Chapter V under the heading "Technique for Rebasing Impressions," to show us where the rebasing wafers were laid on the impression, and it applies to the saddles as well.

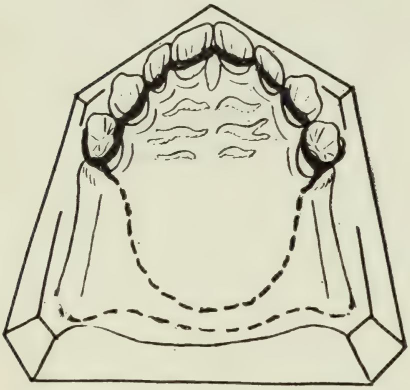


Fig. 177.

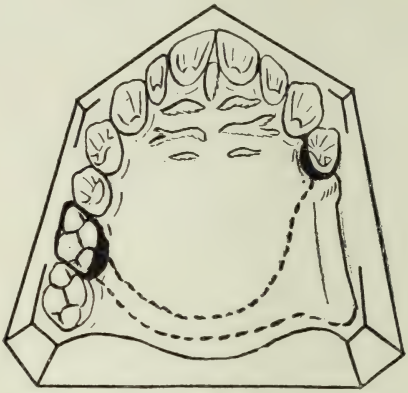


Fig. 178.

Fig. 177. Design for Class I, upper, case, using indirect retention in the shape of a continuous bar. Method used by the author.

Fig. 178. Design for Class II, upper case, with the Jackson Cribs, acting as indirect retainers.

In this Class I, upper case, which we are describing, the saddles should start 1-16 of an inch away from the teeth we are to clasp, and run along the buccal side just short of the movable muscle attachments. If we have used the modelling compound method of impression taking, it will not be necessary to guess where these muscle attachments are, as the muscle trimming of the impression will automatically determine it for us. The outline should pass around the tuberosities without impinging upon the soft tissues behind them. (Fig. 177.) This again in a compound impression, need not be guessed at but is determined when the impression is taken, by having the patient open and close the jaws while the impression material is soft.

After passing around the tuberosity, the saddle outline should continue on the palatal side in a curved line to where it is attached to the bar. No sharp angles between the bar outline and the saddle outline should exist, as they are collectors of food debris and prove very annoying to the tongue. This is an important point in designing dentures. We should never have an angle where it is possible to have a curve. This holds true also in designing the palatal bar.

Designing Palatal Bar.

Many men run the palatal bar straight across the mouth from one saddle to the other. This disturbs the tongue and prevents the proper articulation of sounds. The tongue could in these cases be compared to an automobile, striking a railroad track at right angles, which would cause a considerable bump, whereas, if it struck it at an angle of 45 degrees the jar would be greatly lessened.

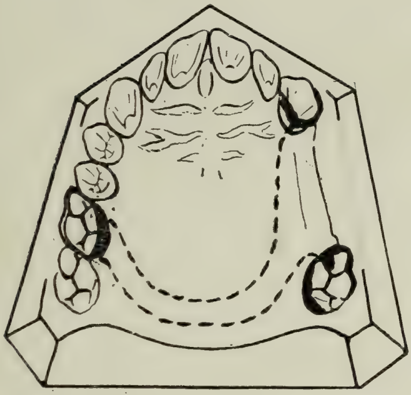


Fig. 179.

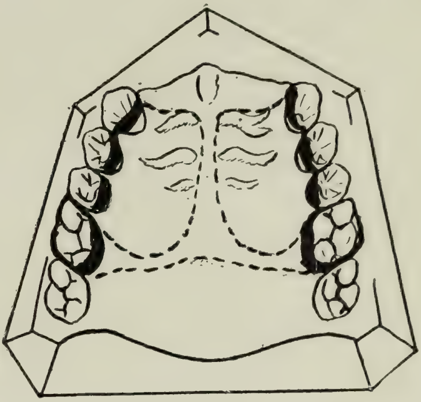


Fig. 180.

Fig. 179. Design for Class III, upper, case, Jackson Cribs, and the lugs acting as indirect retainers.

Fig. 180. Design for Class IV, upper, case, with continuous bars acting as indirect retainers.

The outline for the palatal bar should start at the location of the first and second molar teeth, and run backward, in a nice flowing line, opposite the third molar and across the mouth at the junction of the hard and soft palates. It should rest upon soft tissue to allow for settling. Many men object to this in their bars, but do not hesitate to run the posterior borders of their full upper dentures farther back than this. In fact the bar should cross the mouth on exactly the same line that the post-damming does in an upper full denture, and if any settling does take place, the edges of the bar settle into the tissue sufficiently to be lost, and are not felt by the tongue.

I have never had one of these bars cut, if it were placed in the proper position, but I have had numerous ones make sore spots when they have crossed hard areas. To overcome these sore spots some men relieve the bar over the hard areas, but this leaves a slight space, which the patient feels and complains of.

Occasionally I am foolish enough to design a denture for a patient, with the bar crossing the palate in the center, that is, in the region of the bicuspid teeth, and this is generally because, in discussing the work with the patient, I have shown him a finished case similar to his. He objects to the bar's being so far back, even though he has never tried it, and to pacify him I place the bar in the wrong position. I always regret this and have to reconstruct the denture. I have learned from this that it is a very bad plan to show "sample" dentures to patients as they know nothing about design of dentures, and will form wrong conclusions before giving your plan a fair trial.

The illustration of the design of a Class II case shown in this chapter, is similar to one I made for a patient eighty years of age who was a chronic gagger. (Fig. 178.) Two very efficient technicians in general practice, referred this case to me, after having failed and only because she gagged. In constructing this case I remembered that Mr. Supplee had demonstrated that gagging is not due to the length of the plate on the palate, but occurs because there is insufficient pressure at the posterior edge, allowing saliva to collect, and if it should be of a ropy nature, the patient, in breathing, drags it over the palate, causing tickling and nausea.

This was the first case I ever tried with the bar so far distal and upon inserting it, I was surprised to find that the patient did not gag. She has worn the plate continuously for nine years without adjustments.

This case led me to design all of my Class I, II, and III cases with the same shaped bar. (Figs. 177, 178 and 179.) The anterior line of the bar should run forward in a curving line joining the saddle, and the saddle lines should curve gradually upward to join the attachment of the clasp. The anterior continuous clasp should not be more than 1-32 of an inch in width and should rest upon the cingulum of the teeth to prevent it from driving down against the gingival margins.

If the bite is so close as to prevent this, it is best to open the bite and make this bar sufficiently heavy to allow the lower anterior teeth to rest upon it. In no case should we be induced to allow this bar to rest upon the gingiva. A point spoken of in the chapter on impression taking can be brought out here to advantage. That is, that when we are taking an impression for a palatal bar case, the areas upon which the palatal bar and the saddle rest, should always be taken under compression, and I know of no method of doing this except the one described in Chapter V, known as the rebasing impression technique, which is done either with compound, or wax, upon the impression.

The attachments between the continuous clasp should never be allowed to touch the gingiva and should be held away a distance equalling the thickness of the lead in an ordinary lead pencil.

In considering a Class IV, upper case, it is sometimes necessary to run the bar across the palate connecting the anterior saddle with this bar. This can be done without much discomfort to the patient if the connecting bar which runs between the anterior saddle and the posterior bar is so designed as to lie in the depressions in the rugæ. This design is shown in Fig. 180, and has proven very satisfactory in a large majority of my cases, especially those where patients had had bridgework which had caused the destruction of the teeth in the anterior part of the mouth, and were unwilling to have additional teeth cut off, or filled, to try another experiment. If, instead of this design, we use the old fashioned horseshoe denture with its swaged plate, we ultimately have recessions of the gum and periodontoclasia developing. The continuous clasp attached to the saddle in this type of work, eliminates the possibility of gingival irritation. The continuous clasp acts in the place of resting lugs in the cases where the cuspids are present, but when the cuspids are absent, it is advisable to place resting lugs in the occlusal surfaces of the bicuspids. Keep the attachment in the posterior part as far back and on as strong teeth as possible. The third molars are not often good teeth for attachment. The Jackson crib, in my hands, is the best attachment, and I have a number of patients who have broken the buccal portion of the Jackson crib and who still wear this type of appliance and are able to bite apples.

In these cases, in my opinion, the next best attachment is the Roach flat attachment. Sometimes, it is necessary to place a small flat clasp in the anterior portion of the denture, between the artificial teeth and the natural ones, to prevent dropping anteriorly. I prefer the application of fillings where we use resting lugs and seldom do I ever cut between the teeth to allow a clasp to pass through. If I do this, I always place resting lugs upon the top of the clasp, which act in the same capacity as a contact point, and prevent food from jamming down between the teeth, forming a pocket. This is very important and I think is overlooked by many. If it is necessary to use the third molar teeth for attachments with clasps, we can assist the retentive possibilities of the clasp by placing a small filling in the buccal pit. This can be made in the form of a casting, and instead of finishing exactly flush with the cavity margins, have it round out spherical in shape. The clasp wire slips over this and provides a better retention.

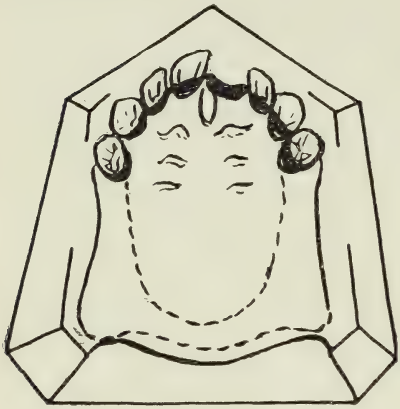


Fig. 181.

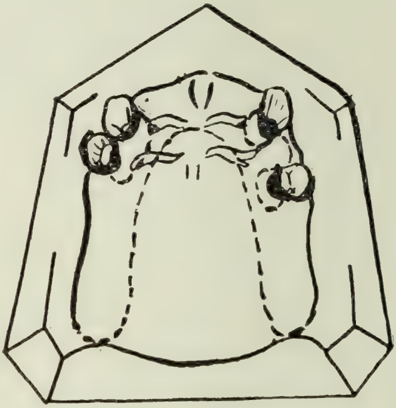


Fig. 182.

Fig. 181. Design for Class I, modification I, upper.
Fig. 182. Design for Class I, modification II, upper.

Class I, Modifications I, II, III, and IV

Class I, Modification I.

In considering the modifications of Class I, it sometimes is possible in Class I, modification I, to attach a single tooth to the continuous clasp, if the bite is not too close, nor too heavy. (Fig. 181.) This tooth can be assisted if we have a small saddle under it, but if there is more than one tooth, it is always better to attach this saddle to the larger one by means of a connecting bar, similar to the one shown in Fig. 183. Advantage here can be taken of running this connecting bar through the depressions between the rugæ, and at no time should it come closer to the gingival margin of the teeth than one-quarter of an inch. In these cases the anterior bar will need to be made a little stronger to prevent its breaking, similar to those shown in Figs. 183 and 185.

Class I, Modification II.

In cases of Class I, modification II, plates are difficult to design so as to avoid gingival irritation. I sometimes feel that it is just as well to have the plate portion of the denture swaged close up to the gingival margin and including a small portion of the buccal and lingual surfaces of the teeth, having the gingival margins relieved on the cast by means of wax, to prevent gingival pressure. In Fig. 182, I show a design for a plate of this sort which has worked out very successfully. It was used for a patient who had sensitive areas on the exposed cementum and she could not wear the ordinary swaged plate, because as soon as food debris began to ferment, she complained of a great deal of pain. After giving her this denture, this symptom entirely disappeared within a few days, and after two years she has not only retained all of the teeth, but it has not been necessary to fill the areas, which, with most swaged dentures resting against the gingiva, would have decayed because of the fermentation of the food products. In these cases, I make the ordinary swaged dentures of two thicknesses of metal, one of either pure or 22 karat gold, strengthened with a piece of 28 gauge, 18 or 20 karat gold. I further strengthen the narrow portions with clasp metal, which is placed between the two laminæ of the gold before it is soldered. This makes an excellent denture, and it is almost impossible to bend it. After it is swaged and fitted on the cast, the continuous clasps are attached. This design can nearly always be made, leaving the roof of the mouth entirely free. In some rare instances, it might be necessary to connect the posterior part of the saddles with a bar running across the roof of the mouth.

Class I, Modifications III and IV.

In Class I, modifications III and IV, I think that the swaged plate is probably the simpler form of denture to make, relieving the gingival margins with wax, because the extra modifications in this type of work makes too complicated a denture. If we must use these swaged plates extending against the gingiva, the patient should be instructed as to the proper cleansing of the denture, and also told that he must not wear the denture during the night, as the alkaline saliva does not flow at night and the mucous follicles secrete acid, which collects around the clasps and the denture causing the disintegration of the enamel and cementum.

To properly cleanse the denture, it should first be washed in soap, then cleaned with either salt or bicarbonate of soda, and placed in a solution of zonite, or Dakin's solution, or one of the chlorin preparations. The Detroit Dental Mfg. Co. make a container, and a solution of this kind, and it is remarkable how clean the denture looks after it is removed from the solution. In placing these dentures back in the mouth, I always instruct my patients to smear a little wet bicarbonate of soda on the areas which come in contact with the teeth, and while it remains there, it tends to neutralize the acids which are drawn by capillary attraction and held there.

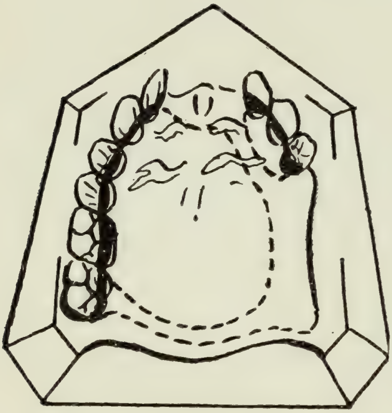


Fig. 183.

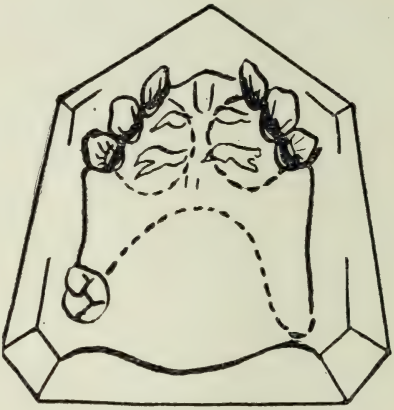


Fig. 184.

Fig. 183. Design for Class II, modification I, upper.
Fig. 184. Design for Class II, modification II, upper.

It is commonly supposed by many dentists that the movement of the plate wears the enamel by friction, but this is not true. The tooth surface is first disintegrated by the acid fermentation of food debris, or by acid secretions of the glands of the mouth, and may then be rubbed away by the denture. If anything should wear, the gold would be the first, as it is much softer than the enamel.

Class II, Modifications I, II, III and IV

Modifications of Class II cases are handled in a somewhat similar manner. I am showing some illustrations of these types of cases. The Class II, modification II shown, (Fig. 184) proved very successful, but the patient had a high arch and a deep depression through the rugæ with practically no hard areas, which permitted me to run the bar across the center of the mouth. I would not have done this if the saddle had been only on one side of the mouth, as in Fig. 183, but it made a simpler design by doing so. I still think it would be more stable if the bar across the roof of the mouth were placed more posteriorly.

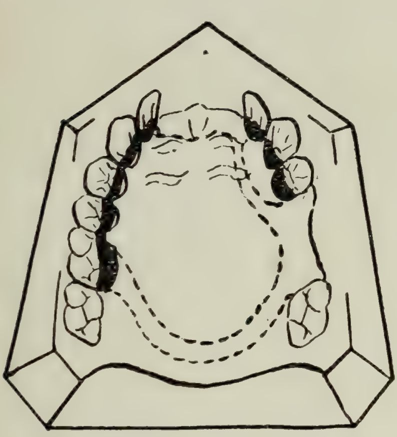


Fig. 185.

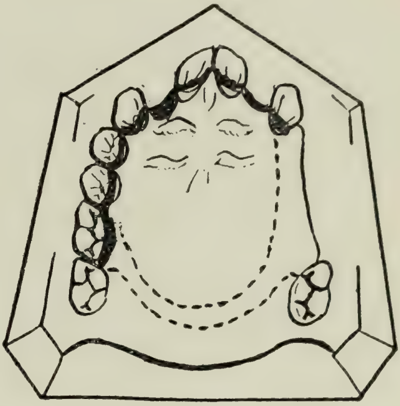


Fig. 186.

Fig. 185. Design for Class III, modification I, upper.
Fig. 186. Design for Class III, modification II, upper.

Class III, Modifications I, II, III and IV

In modifications of Class III, the same holds true, and as in Class I modifications, separate teeth can be placed upon the anterior bar, but if more than one tooth is to be supplied close together, it is advisable to place them upon a saddle and connect this saddle with an extension bar running to the main saddle. Here again, we have some illustrations of these designs. (Figs. 185 and 186.)

Where the separate teeth are placed upon the saddle, I warn the students not to attempt this in close bite cases, nor where much strain is to be placed upon these teeth, as the constant movement in mastication will tend to break the bars. I generally supply these teeth by means of Steele facings, which permits the use of a longer facing when the gum shrinks away from it. I have a number of cases where the gum had shrunken so far, due to faulty technique in extraction, where the dentist has removed the tooth and broken the alveolar plate, that it was necessary for me to bake pink gum enamel upon the Steele facing.

Class IV, Upper.

Class IV, upper cases permit of no modifications, but if the student studies the diagrams shown for Classes I, II, III and IV, he can readily design dentures for every type of case. These diagrams can be made up in the form of rubber stamps and used as records on the backs of record cards, as I have mentioned before.

This designing in the flat, has been of the greatest assistance to me when I come to make my design upon my plaster cast and I would advise all who are interested in this work to make design drawings, when they have nothing better to do. It is as interesting to me as crossword puzzles. But always try to make designs which are simple, rather than those which are complicated.

At the time of writing I have in my office two cases of removable bridgework for modifications of a Class I type of case, which would have been very much simplified if the dentist had swaged a plate for the patient rather than making up a series of removable bridges. The little extension wings covered more area than the swaged plate would have covered, and it was necessary for the patient to remove four pieces of bridgework and to clean each one separately, where he could have removed but one. This became a burden to him, and the result was that he never cleaned them, and consequently lost some of the teeth. We must bear in mind that we are not trying to produce trick work, but that we must assist our patient, and when we place a mechanical appliance in the mouth, we must get it as simple as possible, and not think that because we introduce complications, we are better mechanics or better dentists. It is quite the other way and the good dentist is the one who can work with few tools and simplify his work.

CHAPTER XII

Stress Breakers and Indirect Retainers

Since the advent of the cast clasp and the removable bridge, a great number of men have advocated the use of "stress breakers" between their saddles and the clasps. These have been shown to be absolutely essential by dentists who had used cast clasps for partial dentures. They found that in a short time, the teeth to which such clasps were attached, loosened, and that this was due mainly to the rigidity of the clasp.

A well designed round wire clasp is, in itself, a stress breaker, and allows sufficient saddle movement to prevent excessive strain upon the abutment teeth. Stress breakers in removable bridge work have some justification, where movement is limited, as they allow a small degree of saddle movement to maintain the health of the tissues, and to a great extent, prevent shrinkage; but as for preventing stress and strain being placed upon the teeth themselves, they do not do so, because, when they reach the end of their movement against the stop, the strain is applied to the abutment teeth the same as though there was no stress breaker. The only difference is that it comes a little later in the movements of mastication.

Stress Breakers. In my hands, stress breakers used on partial dentures have permitted so much movement of the saddles, that they produced excessive soreness, and, after many trials, especially after patients had worn them for some time, I found that a greater number of abutment teeth were loosened, than where we used the double bar, or as I call it, the "continuous clasp," shown in Fig. 187. Even the novice can see that if all the remaining teeth are made to support the denture, no excessive strain can be applied to any one of them. It is only where we have too few teeth in the mouth that it is necessary to use some form of specially designed stress breaker between the clasps and saddles.

I believe, if we follow out the principle of indirect retainers advised by Cummer, we will save more teeth than if we endeavor to utilize some form of complicated attachment to the saddles and the clasps. The spring wire clasp, the double bars, and continuous clasps, are easier to repair and are more sanitary.

In the presence of periodontoclasia, the continuous clasp can be used as a splint, which is readily cleansed, and if made with a pure gold lining does not erode the teeth, while if made by the casting process, it very often does. Where there are a sufficient number of teeth present, such as in a Class I, lower, the continuous clasp binds the teeth together and causes them to act as a unit. It is not too rigid. The difficulty is to make it rigid enough to prevent movement without making the terminal clasps so tight that strain is produced upon the abutment teeth.

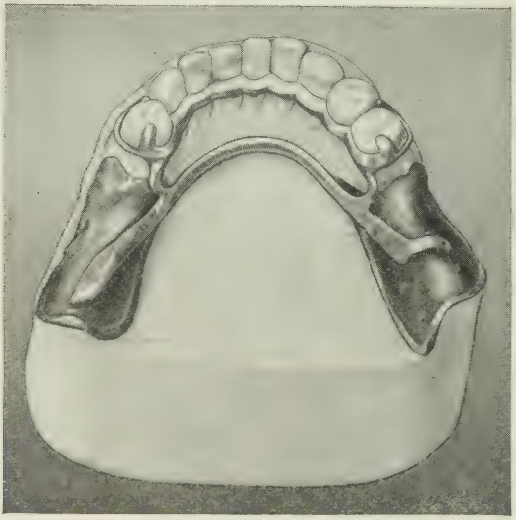


Fig. 187—Continuous clasp or double bar.

Clasps should not be made so rigid that they hold the denture in place. We must depend on an inherent stability of the saddles to prevent strain on the teeth. If the saddles are not of sufficient size to do this, we must apply some indirect retainer, which covers a sufficient number of the teeth to bind them into a unit and cause them to do their part in supporting the denture. If there are only one or two teeth present, we would not expect these teeth to do the work of fourteen, without excessive strain being placed upon them, and it is in such conditions that some form of stress breaker becomes useful.

Again, if a tooth which is needed to carry a clasp is out of alignment, a stress breaker is useful in allowing us to get the clasp over the tooth when placing the denture in position, without an excessive strain upon it. These are the two instances where stress breakers are indicated.

The writer has had considerable experience in constructing surgical appliances in connection with cancer operations and in war surgery, and has experimented with numerous stress breaking attachments. I find that they may be divided into three classes; those that are made by the dentist himself, one being made of spring wire, attached to a clasp and denture and which allows movement in two directions; those that are manufactured and which allow a side-to-side movement; that is a bucco-lingual

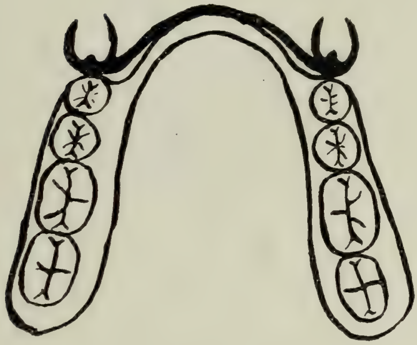


Fig. 188.

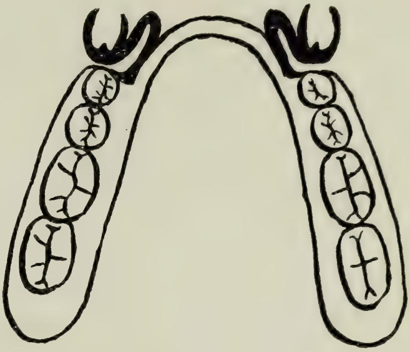


Fig. 189.

Fig. 188—Wire stress breaker attached to clasps and at the midline of bar.
Fig. 189—Wire stress breakers bent upon themselves.

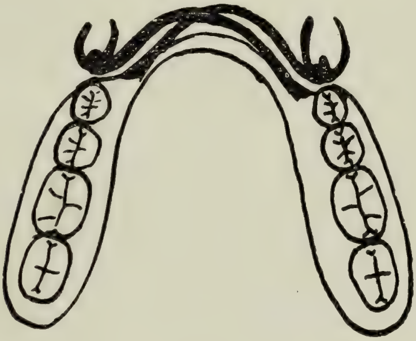


Fig. 190—Wire stress breaker attached on one side of bar running to clasp on opposite side of denture. This is uncomfortable to the tongue.

motion, together with an up-and-down, slide motion; and those which allow these two movements combined with another, a hinge motion. I will not go into the technique of attaching these clasps in this chapter, but will do so under the subject of clasps.

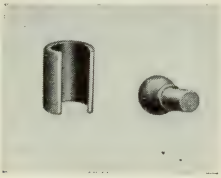


Fig. 191.

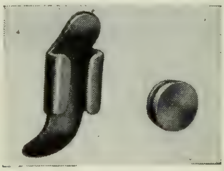


Fig. 192.

Fig. 191—Roach ball attachment. This ball is set in an inlay; the tube in the denture, allowing an up-and-down movement and a side-to-side movement.

Fig. 192—Roach flat attachment. This is good for the anterior teeth. It is used in those Class I cases where there is no possibility of indirect retainers.

In partial denture construction, I have narrowed my attachments down to about three; the Roach, the Dresch and the Kayle, which are very satisfactory. I use these three attachments, according to the requirements, and each one of them has a movement a little different from the others.

The simplest form of stress breaker is a flexible wire attaching the clasp to the bar as shown in Fig. 188. The flexible wire is attached to the center of the lingual bar running to the clasps on either side. This is an excellent idea, but does not prevent settling and the wires break very often.

Another method of attaching the wires is shown in Fig. 189, where the wires are attached on the same side of the lingual bar as the clasp to which they are attached, and are bent upon themselves.

The third method is to attach the wire to the side of the bar opposite to the clasp to which it is attached, as shown in Fig. 190.

Where there are two clasps, the wires cross each other in the center. This makes it uncomfortable to the tongue and if the wires touch at the crossing, they wear through very quickly. The greatest disadvantage is that, when the patient cleans them, the wires may bend and then act as a regulating appliance would. If the spring wires are heavy enough to overcome this defect, they defeat the purpose for which they are intended.

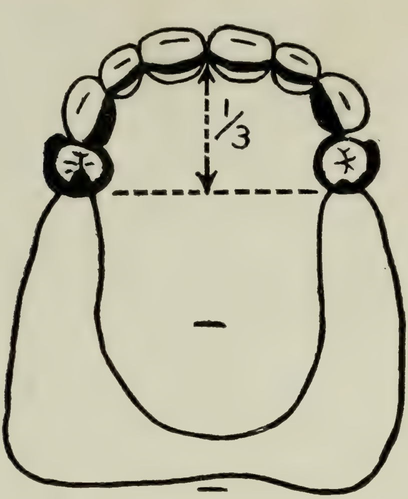


Fig. 193—Diagram used to diagnose a Class I upper case for the type of attachment or clasp to be used. Draw a line connecting the point of attachments. If the distance from this line, to the anterior point between the central teeth is one-third of the length the plate, ordinary clasps can be used with indirect retainers.

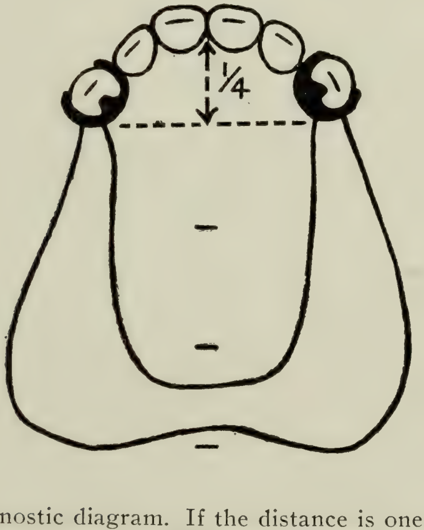


Fig. 194—Similar diagnostic diagram. If the distance is one-quarter of the length of the plates, mesiodistal clasps will be needed with or without indirect retainers.

Such clasps permit a certain amount of settling of the denture, but if the settling is excessive, the denture hangs in midair and when once denture and clasps are out of adjustment, it is almost impossible to get them back into position.

Roach Attachment. A useful appliance which permits saddle movement is the Roach attachment. I have used both the ball-end (Fig. 191) and the flat-end (Fig. 192) attachments. I find that the flat-end attachment takes up less room, and can be used in the anterior part of the mouth attached to a pinledge inlay, or to a Carmichael crown. These attachments are most satisfactory in Class I, upper cases where the teeth have moved forward and it is impossible to obtain any hold with an indirect retainer.

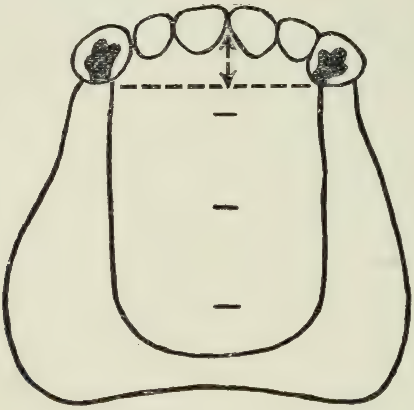


Fig. 195—Similar diagnostic diagram. If the distance is less than one-fourth of the length of the plate, a Roach flat attachment will be useful. The little "finger" at the top of the attachment will act as an indirect retainer without placing the strain upon the tooth.

A method of determining whether a Class I upper denture will hold up with an ordinary attachment, or work better with a Roach attachment, is to draw a line from the distal side of the abutment teeth and measure from the center of that line to the furthest point anteriorly, where the indirect retainer will rest. If the length of the line which is drawn forward is one-third the length of the denture, and the abutment teeth are parallel with one another, the denture will stay up with ordinary clasps, used with indirect retainers (Fig. 193). If the distance is one-quarter or very slightly less, and the teeth are leaning away from one another, a mesiodistal clasp can be constructed, either with or without indirect retainers

(Fig. 194). If the distance is less than one-fourth (Fig. 195), a Roach attachment will be useful.

Dresch Attachment. Another valuable attachment in stress breaking is the Dresch attachment (Fig. 196). It has the advantage of movement in almost every direction, with the additional advantage that the denture cannot sag in the upper, or rise in the lower, from its normal rest position. Yet, when the forces of mastication are placed upon it, it compensates for the movement of the tissues under the saddle. This is especially valuable in surgical appliances where it is necessary to use a rigid clasp on just a few teeth. I do not wish to be misunderstood. Some men have so worked out their technique that they can use the Dresch attachment in many other cases.

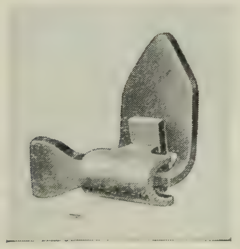


Fig. 196.

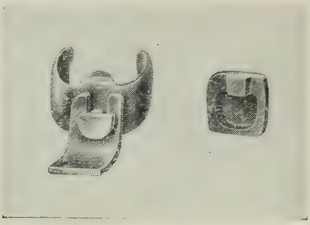


Fig. 197.

Fig. 196—Dresch stress breaker. Two parts linked together which allow movements in all directions except one. This prevents the denture from dropping or rising from its rest position.

Fig. 197—Kayle stress breaker attached to the clasp. Cover or box reversed to show the shape of the interior. This is soldered to the attachment in the finishing. This attachment allows a side-to-side rotation. Some forward-and-backward movement can be obtained.

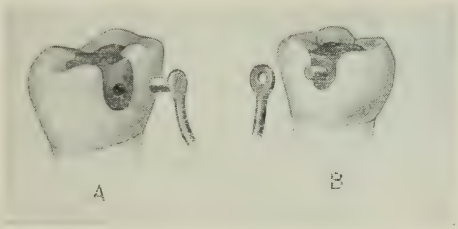


Fig. 198—Cummer stud and ring attachment. A. Ring in inlay and stud attached to the bar of the denture. B. Ring on the bar and stud in the inlay.

Kayle Attachment. The Kayle attachment (Fig. 197) is very satisfactory in small cases and in those partial cases where one tooth, which is not parallel with the others, is to be clasped. Even here it is not necessary to use the movable attachment if the clasp is high enough on the tooth, but for esthetic reasons, it is not always advisable to place a clasp high. Also, where a tooth leans far out of position, we can sometimes get a much better hold for our clasp if the Kayle attachment is used to allow us to slip the denture into position without strain upon the tooth.

Each of the above mentioned attachments is used in almost every position by their makers, and I do not wish the student to feel that this cannot be done, but in my hands, I have found that they work best as above described.

Cummer Attachment. There are numerous other attachments which can be constructed without the necessity of purchasing from a manufacturer and they fill requirements in certain positions in the mouth. Dr. Cummer has devised several attachments, two (Fig. 198) which give great satisfaction, being the ring-and-pin and the pin-in-the-inlay attachments. Both of these permit saddle movement without strain upon the abutment teeth.

CHAPTER XIII

Clasps and Slotted Attachments

The question of attachments for dentures, or bridges, has troubled the profession from the earliest days, and I doubt if we ever will be able to persuade all dentists to agree as to what form is best. Personally, I think that nearly every type has its value and the student should be familiar with all and the method of making and applying them in practical cases.

The student will be unable to decide which is best as he has no background of experience to build on, but must seek advice. He cannot be expected to determine whether the attachment should be of an internal type, such as the Chayes, or McCullom, or of the external type such as the band, or the wire clasp.

These two schools are diametrically opposed. Those of the first school claim better mechanics and individual tooth movement, less showing of gold and less loss of tooth structure and strange to say, the disciples of the other school make practically the same claim.

Let us try to analyze these two types and see if we can determine to what cases each is best suited. There must be some value in both methods. We will always have the extremist who will stand at one end or the other of the line and try to shout down the opposition.

Comparative Value of Different Types of Dentures

Is the removable, or the movable-removable bridge the ideal for all cases? Personally, I do not believe this to be the case. There are certain well selected cases where such work is best, but they are by no means the majority. Such bridges are ideal in simple cases, where one or two teeth are lost in the maxilla or the mandible and the teeth on both sides of the opening already bear fillings and do not require a great deal of extra cutting into the teeth. But so do the Nesbett and Bonwill type of bridge work out well in this type of cases. I have several cases in my practice where the patient, for experiment, has allowed me to put different types in the same mouth, and while they have been used in some instances for about four years, I cannot yet say which one is giving the best service. Those of the slotted type of attachment have required as much adjustment to keep them tight, as those with properly designed clasps.

I also have several cases where a slotted attachment is on one end of the appliance and a clasp on the other end. They are working successfully. This is contrary to the teaching of the men who designed the slotted attachments; thus we see that no firm and fast rule can be established.

If the teeth have already been cut into and the fillings are deficient in their anatomy and contour, the slotted attachment can be used to advantage, new inlays being made for the purpose; but I see no reason for cutting into perfectly sound teeth, except where a patient objects strenuously to the showing of gold, such as a clasp.

As this is nearly always in the anterior part of the mouth, where the slotted attachments are least satisfactory, we are rather between the devil and the deep sea. Of course, if the tooth is badly decayed, the logical procedure would be to use the slotted attachment.

Dangers from Clasps.

The argument that the clasp wears the enamel of the tooth is certainly not based on good observation. I will acknowledge that teeth are destroyed with improperly designed and improperly cared for clasps, but I also have before me on my table while I am writing, the study model of a case which contains two removable bridges of the slotted type, which shows decay extending under the gingival margin of the inlays due to food retention by the bridges. The gum under the saddles of the removable bridge is not in a healthy condition. Fungoid gum is creeping between the bridge and the tooth. This is due to faulty design of the saddle which impinges too closely upon the gingival margins, and the movement of the bridge in the slots allows it to pinch the gum. This cannot be guarded against in this particular case as it would weaken the attachment too much to clear it from the gingival margins. So we see, that even here, where the bridge was only supplying one tooth on either side of the mouth, it failed after two years.

The only fault I have to find with the operator in this case is the fact that he cut into sound teeth, telling the patient that if he should use clasps, they would ruin the teeth by the destruction of the enamel. He removed more tooth structure in one sitting with the bur, than the clasp could have injured in years, and if ultimately such a case supplied with clasps should require fillings, that probably would not have occurred for a very long time.

This is one of the reasons why I favor clasps. In many instances they do not cause erosion of the enamel and if they do, a simple filling operation with porcelain, or synthetic porcelain, overcomes the difficulty without the necessity of cutting out large portions of the tooth surface.

Another argument in favor of the slotted attachment is that it allows saddle movement and stimulation of the process underneath. So does the properly designed clasp denture, and it is my opinion that the shrinkage in both cases is about the same. It is hard to prove or disprove this.

As for showing gold; the clasp does show more than the slotted attachment, especially in the anterior part of the mouth. However, some mesiodistal clasps can be designed to show very little gold, sometimes much less than the inlays holding the slotted attachments.

Cleanliness.

If a patient is not cleanly with a partial denture with clasps, he will not be cleanly with a removable bridge with slotted attachments. Therefore, I think we can dismiss this as an argument, pro or con. In the instance of the clasp, decay starts near the junction of the enamel and cementum, especially if there is recession of the gum. With the slotted attachments decay starts at the gingival margin of the inlay, and in almost every case, the patient neglects it until it is beyond repair, whereas when there are clasps, the surface becomes so sensitive, that he is compelled to come in for an examination.

The argument offered by the men who favor slotted attachments, that the clasp rubs on the tooth, causing erosion, only impresses me with their lack of observation. In the first place, we know that one of the physical properties of gold is its softness, and as it is much softer than the enamel of the tooth, if anything should wear away, it would be the gold. This often takes place. I have seen clasps worn through where they turned a corner, or rubbed on a sharp edge of enamel. Many men point out to me the destruction of a tooth substance by a clasp. They say; "Look how the clasp has worn the enamel away," when plainly, the erosion started in the dentin. The clasp had been placed upon the dentin, or had settled into that position, and it is no more of an argument against clasps than the last case I mentioned was argument against bridgework of the type with slotted attachments. Both of these failures were due to faulty design, and faulty execution by the dentist.

With regard to erosion of the enamel by the clasp, I will acknowledge that it occurs under cast clasps, or broad flat clasps if they are not kept clean, but not in connection with the round wire clasp. When I first came to New York, I had a friend who was an ardent removable bridgeworker and an expert. He took delight in calling me into his office every time he found a tooth eroded by a clasp, and in the majority of instances, I pointed out to him that there were as deep erosions in the same mouth on teeth that were not touched by clasps, or that the erosion on the particular tooth he called attention to, was due to the fact that the clasps had been placed high up on the cementum. The failure here was due to faulty design, or to the faulty care of the mouth, or to the fact that the patient had an acid erosion progressing in the mouth independent of the clasps. While this man has not acknowledged it, now he is convinced, because he makes ten times as many partial dentures with wire clasps, as he does removable bridges.

The crux of the whole problem seems to be proper design, cleanliness and the maintaining of the appliance in proper repair. To the student I would say that the slotted attachments are useful where the teeth have been cut into previously; and if there are not too many teeth missing between abutments; I should say not more than two or three. They are useful in the anterior part of the mouth where you do not want to show gold. They are for the selected few patients who are willing to take care of them and have the means to pay for them. This sounds mercenary but we cannot operate at a loss. Hence for the great majority of the middle and poorer classes of people, and also the wealthier who will not pay attention to keeping their teeth clean, the clasp offers the best solution for the retention of dentures.

Design of Clasps.

Now we come to the problem of the design of clasps. Since the early eighties, when Bonwill brought forth the idea of the clasped partial denture, there have been numerous articles written on clasps and their design. I have in my possession, a bibliography which covers about twelve pages of foolscap, and this is only one-half of the literature on the subject. Bonwill laid down some fundamental principles on clasps to which now and again some man lays claim and attaches his name. Bonwill showed that the clasp must encircle the greater diameter of the tooth and must touch the tooth at three points to be efficient. One of these points is at the resting lug, and the other two are at the ends of the clasps. They do not need to touch at any other point, as is supposed by a great number of men.

There are fully a hundred different designs of clasps, some with a little wing here or a spur there; some with single wire and some with double wire; some of flat plate; some of flat plate cut in the form of loops; or round wire in the form of loops. Cast clasps of different forms, and wrought clasps lined with pure gold or platinum. Clasps with all sorts of stress breaking attachments. The inventor of each one claims that his is a panacea for all ills, but when they are all sorted out and brought down to the last analysis, the one that probably brings the greatest satisfaction is the round wire clasp with sufficient spring to allow it to go slightly above the height of contour of the tooth without undue strain upon the tooth. The rounding surface of the wire gives it the least amount of friction and the least surface contact for good retention. The clasp which encircles the tooth should cover a little more than half its circumference. If a round wire clasp is used, it should be just above the height of contour. If a half round wire clasp is used, it should just rest on the height of contour and extend slightly gumwards. If a flat plate clasp is used, one-half should be above the height of contour and one-half below that area of the tooth.

Whenever possible, we should apply a resting lug. This resting lug is not only intended to support the denture but also to act in the same capacity as the contact point does in natural teeth, and to prevent food from being jammed between the clasp and the tooth, forcing the gum back at the gingiva and inaugurating a pocket. If the old-fashioned type of clasp which had no resting lug, were used in the mouth, we would see that as soon as pressure is brought to bear upon the saddles, the clasp separates slightly from the tooth, leaving a space. This is natural, as the gums under the saddle compresses and in the process of mastication, food is jammed down into this space. This jamming and packing will continue until a pocket is formed. This has been entirely obviated by means of the resting lug. It separates the fibrous food and prevents it from going between clasp and tooth, serving the same purpose as a contact point.

I often see men using resting lugs on surfaces other than the *mesiocclusal* or *distocclusal.* I think this is a mistake. If there is no chance of getting a resting lug in, due to the closeness of the bite, we are justified in grinding the teeth slightly on the marginal ridge. The enamel is thick at this point and it is seldom necessary to grind through it. If we do grind through it, we should replace it with a filling, or we may have decay starting.

In many instances a plate clasp can be made so that it just bends over the edge slightly, and acts in the same capacity as a resting lug. I seldom have my resting lug touch the tooth when the plate is put in the mouth in the first instance. Tooth and lug are separated by a slight space and after a few days of wear, they come to rest. I do not think this fact is generally understood. The saddles should do their part in supporting the plate. It should not all be thrown on the resting lugs as they are not strong enough to withstand the strain of mastication entirely.

Another thing that is greatly misunderstood is the necessity for a clasp to fit tight on its entire length. As a matter of fact, the most efficient clasps probably are those that exercise the greatest tension at the ends. In many instances I start with a clasp which is a little longer than is necessary, and shorten it after the patient has worn it a few days.

It is surprising how small a clasp at times will retain the denture, especially in the anterior part of the mouth. If the student is uncertain whether he can cut off a length of clasp and still have it hold, he can test it out by bending the end of the clasp away from its contact, keeping the mid-portion in contact, and allowing the patient to wear it. If this works successfully, then he can cut off the end of the clasp as far as the point of contact.

CHAPTER XIV

The Technics of Clasp Surveying

In the last chapter I stated that the ideal area of contact for a clasp is along the height of contour. If it is a flat clasp, half should be above the height of contour and half below. If it is a half round wire clasp, it should be just along the height of contour, or slightly towards the gingiva. If it is a round wire clasp, it should be just under the height of contour towards the gingiva. It should encircle the tooth a little more than one-half of its circumference; if less than one-half it would be inefficient.

It would be a simple matter to design clasps if all teeth were parallel and distinctly bell-shaped. But as this is not the case, some accurate method must be sought to determine just where is the most efficient location for the clasp. If we have two teeth to be clasped, leaning towards one another and place clasps over the height of contour, they would probably be so hopelessly locked that it would be impossible to introduce, or to remove the appliance. Hence the rule stated above applies to individual teeth. But if we apply clasps to two or more teeth, the allocation of these clasps becomes more complicated in accordance with their number and the degree of inclination of the teeth.

It was formerly the practice of the dentist to make a cast, look at it, and mark the outline of his clasps upon it, depending on his eye to determine whether the clasps would draw from the teeth after being attached. The writer never could agree with the man who believes that he can take individual impressions of teeth, make clasps upon these and either assemble them on another model, or put them in the mouth and take impressions to obtain their relationship.

A method needed to be devised whereby the outline of the clasp can be accurately determined. The writer formerly used a loading type of lead pencil, such as the Eversharp, extending the lead so that it protruded about half an inch. He then held the cast in one hand resting his hand upon the table, and so tilting the cast that he could see the height of contour of all teeth that were to be clasped. This with one eye closed. With the other hand he grasped the pencil, resting his elbow on the table, and held it at a point where the long axes of the teeth converged, moving the flat side of the lead around the height of contour of the teeth. This gave a fairly accurate representation of where the clasps should be located, but it placed too much dependence upon the skill of the operator, and the student seldom obtained the proper result. It was not until he saw the Ney Clasp Surveyor that he believed the problem solved.

The J. M. Ney Company has been kind enough to allow me to use their diagrams and illustrations and to quote from an article by Mr. Geo. L. Roth. They state that "it was Dr. A. J. Fortunati who first pointed out the desirability of a mechanical device for charting correct clasp outlines. At a clinic in Boston in 1918 he showed a method of using a bridge parallelometer, in connection with which he used a round graphite rod, instead of a steel mandrel. While there is no similarity between his instrument and the one described herein, we nevertheless feel that Dr. Fortunati is entitled to credit for promulgating the idea."

Principles of Clasp Designing

"The efficiency of clasps as retaining devices depends upon their relative positions on the teeth. Their resilient arms must extend gingivally, beyond the 'bell,' that is, the height of contour* of each tooth, so engaging the enamel contour that the bridge, or plate, cannot be displaced in mastication, nor by the movements of the muscular tissues of the mouth, while at the same time permitting it to be easily removed by the patient.

"Correct clasp design, therefore, depends especially upon the accuracy with which the height of contour of each tooth located as indicated on the cast. This indication serves as a basis or guide for the final establishment of the position for the completed clasp, whether it is to be made of cast or of wrought metal.

"There is illustrated in the diagram (Fig. 199), the greatest mesial, distal and buccal convexities, ignoring entirely any normal or abnormal inclination of the teeth. If the generally promulgated rule that a clasp should uniformly grip the height of contour of a tooth were literally followed (Fig. 200), considerable force would have to be exerted in inserting the restoration (with the clasps connected) on account of the distal contour of the bicuspid and the mesial contour of the molar.

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* Mr. Roth, from whose article this is quoted, uses the words "greatest circumference" for which "height of contour," will be substituted throughout.—Ed.

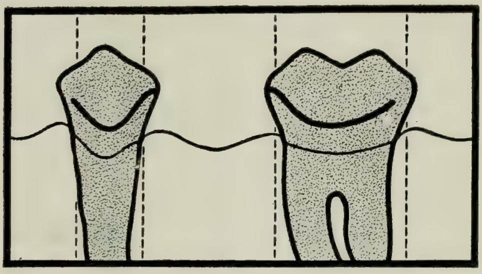


Fig. 199.

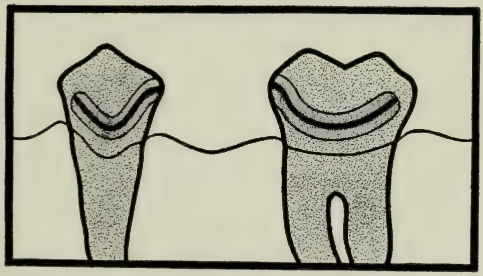


Fig. 200.

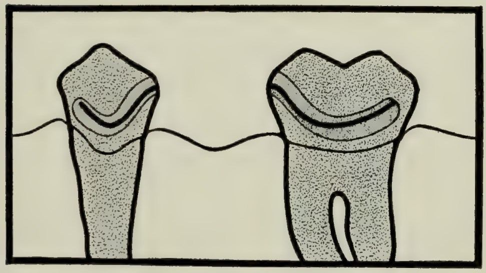


Fig. 201.

"Repeated insertion and removal of the piece would strain the supporting, or abutment teeth, with consequent irritation of the investing tissues and loosening of the teeth." . . . . "Furthermore, the resilient arms, or ends, of the clasp would not perform their intended function as well as when they are more correctly located. It is not so much the actual area of tooth surface grasped by the clasp that makes the latter safe and effective, as the position which it occupies.

"Clasps designed as those shown in Fig. 201 do not extend far below the height of contour of the teeth, on the mesial and distal surfaces, but gradually come below the buccal and lingual convexities as the end of each resilient arm is reached. Thus the degree of force required for insertion of the rigid portion of the clasp is reduced, whereas the resilient arms can readily spring over the buccal and lingual bulge and grip the tooth more firmly than otherwise. It is evident, therefore, that the rigid portion of the clasp cannot be depended upon for retention, but only for support and stability; it is the resilient, or comparatively resilient arms that must perform this function.

"The problem involved in properly designing correct clasp-form for the 'ideal' (but impossible) case shown in Fig. 202, is much greater when dealing with cases which occur in practice; because, even in normal cases never are the teeth as nearly parallel as those shown in the diagrams and, as a matter of fact, wherever a restoration is required the teeth to be clasped are parallel neither mesiodistially nor bucco-lingually, but are usually considerably malposed. The problem is further aggravated when more than two teeth are to be clasped, and all the clasps attached to the denture. Only too frequently are the ultimate service and value of the restoration to the patient problematical, on account of the difficulty in inserting and removing the denture, which condition is usually due to faulty shape and position of the clasps." This error can be largely overcome by placing the model in the Clasp Surveyor, the workings of which will be described later.

"Ideal conditions, however, are not possible in practice; hence, all deviations from the parallel must be observed and provided for by establishing a correct average angle of relationship between the teeth involved and the indicator. For example; if the survey cast of the case under discussion is set and retained on the survey table, in the position shown in Fig. 202 and charted, guide lines similar to those shown in the diagram will be developed. If these guide lines are followed, the clasp on the bicuspid will be excellent; but on the molar quite ineffective, as little or no retention will be secured. It follows that when the bridge is subjected to stresses of mastication, there will be a tendency for the molar to drift distally, with results so obvious as to require no further discussion.

"If, on the other hand, the survey cast is set at the angle shown in Fig. 203 and the guide lines charted, excellent retention will be secured on the molar but inadequate retention on the bicuspid, practically a reversal of the conditions shown in Fig. 202, in fact, even more aggravated, as the first bicuspid, being comparatively cone

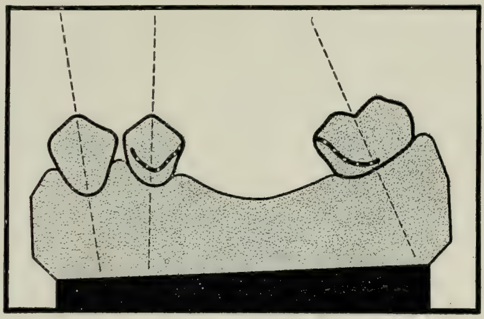


Fig. 202.

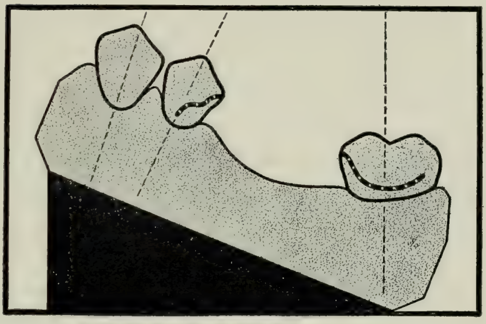


Fig. 203.

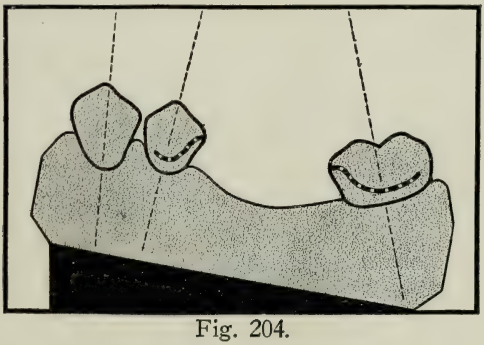


Fig. 204.

shaped and smaller than the molar, offers considerably less favorable retention surfaces.

"If the position of the survey cast is again modified by bringing it to the angle shown in Fig. 204 (the axial inclination practically equally divided), the guide lines shown will be developed. The retention on the molar will be quite as effective as in Fig. 203, and the bridge may be inserted and removed in practically a direct downward and upward path.

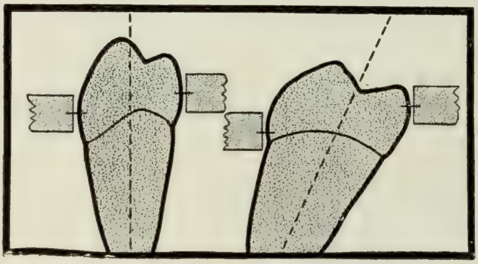


Fig. 205.

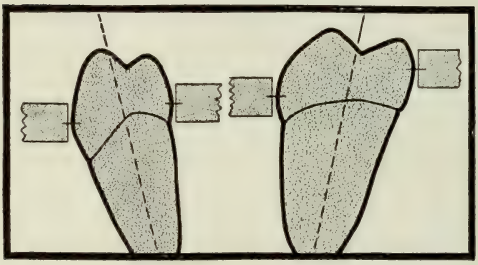


Fig. 206.

"The bucco-lingual inclination of the teeth involved must be considered equally as well as the mesiodistal relationship. If, as in the case under discussion, the bicuspid stands in a normal bucco-lingual position and the molar inclines lingually, as shown in Fig. 205, and the teeth on the survey cast are set in relation to the indicator as shown, the retention of the clasp on the bicuspid will be excellent, while the retention on the molar will be ineffective if the clasp is placed above the gingival margin of the gum.

"If, however, the survey cast is tipped in a buccal direction, as shown in Fig. 206, and the variation in inclination between the bicuspid and molar is approximately evenly divided, effective retention will be obtained on both teeth without any danger of impingement on gingival areas.

"A definite design for clasps is impossible without reference to the transverse dimensions of each abutment tooth. The particular dimension to be considered is along the path of the height of contour of each abutment in relation to the one common direction in which the denture and the clasps are to be seated upon and removed from those teeth. To solve this problem, the Ney Clasp Surveyor was developed. This instrument is, in effect, the application of a self-evident principle of geometry; that by bringing a vertical plane into apposition with the convex surfaces of the teeth to be clasped,

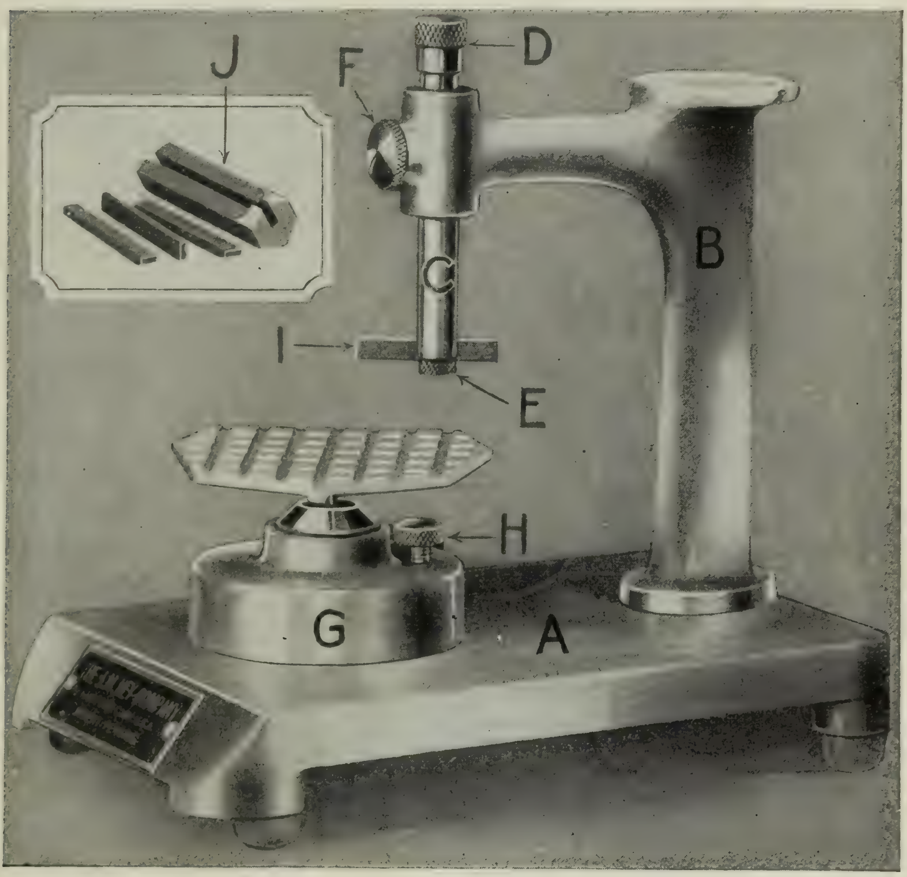


Fig. 207. The Ney Clasp Surveyor.

the exact position of the height of contour in relation to that vertical plane can be accurately determined and charted. The *vertical plane will coincide with the path along which the clasps will tend to seat themselves on the teeth,* and the line charted upon the teeth will be the guide line for designing the clasps. This instrument is illustrated in Fig. 207 and is described in detail."

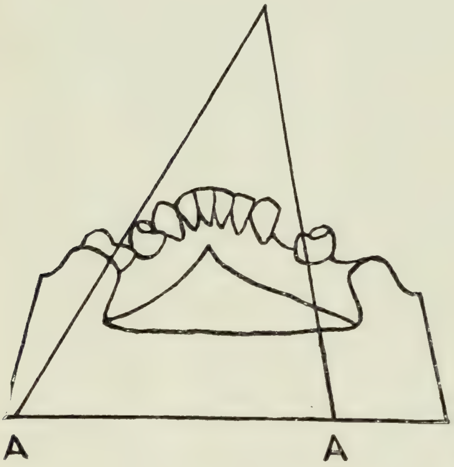


Fig. 208.

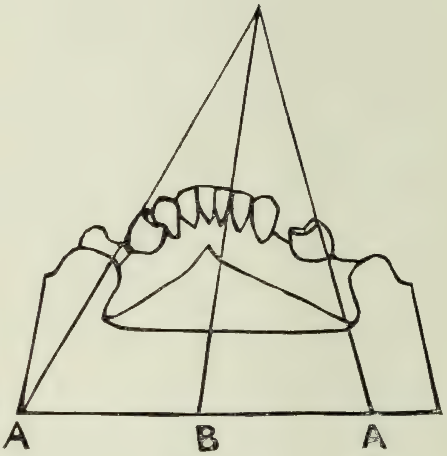


Fig. 209.

If the foregoing outline is understood, we must reach the conclusion that some method must be obtained to design an efficient clasp. The Ney Clasp Surveyor does this.

Ney Clasp Surveyor.

(a) The floor or bed of the instrument. It has an accurately planed surface, all parts of which are at perfect right angles to the vertical, sliding and rotating spindle (c) which holds and carries the graphite indicator (i). This spindle will hereafter be termed the carrier (c). (b) A standard firmly attached to the floor (a) with a horizontal arm extending over the floor and carrying the vertical carrier (c). (c) The carrier. A perfectly accurate hardened and ground spindle made of stainless steel. It is held vertically in its relation to the floor (a) at all times and moves freely up and down and also rotates. (d) The head of the carrier (c). Knurled to facilitate manipulation. (e) A knurled nut for tightening the graphite indicator (i), which is held horizontally in a rectangular slot at the end of the carrier.

(f) A thumb-screw at the end of the arm projecting from the standard (b) for adjusting tension on the vertical carrier (c).

(g) The model or survey table. Its base is heavy, flat and smooth, which permits movement about the floor (a) while the carrier (c) is being raised or lowered and rotated. The serrated plate to which the survey cast is attached by modeling compound may be tilted at any angle, readjusted and firmly held in any required position.

(h) Angle adjustment screw in the base of the survey table (g). This screw controls the ball and socket mechanism by means of which the model table top is held in the base at any required angle.

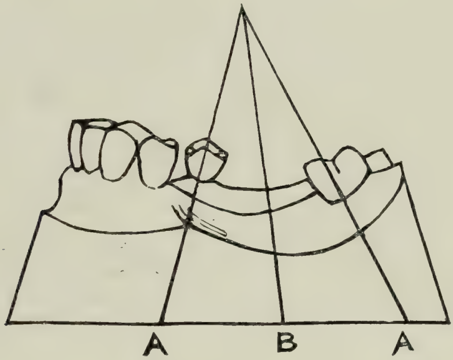


Fig. 210.

(i) Indicator. A rectangular graphite pencil in the end of the carrier (c) for charting and marking the convex surfaces of the teeth being surveyed.

(j) The squaring tool.

Registering the Abutment Inclination.

"Upon the back of the cast draw two lines parallel to the long axes of the abutment teeth, registering their lateral direction (AA in Fig. 208).

"If the abutments converge, or diverge appreciably, draw a third line approximately bisecting the angle that would be formed if their axial lines were drawn to a point of intersection (B in Fig. 209).

"Upon one side of the cast draw lines parallel to the long axes of the abutment, registering their anterior-posterior direction, and a third line approximately bisecting the angle that would be formed if the axial lines are extended to intersection (AA and B in Fig. 210).

Adjusting Position of Cast.

"Heat the serrated surface of the survey table of the Clasp Surveyor over a flame, place upon it a cake of modeling compound, the under surface of which has already been softened by dry heat; soften the upper surface of the compound, and seat the cast upon it. (Fig. 211.)

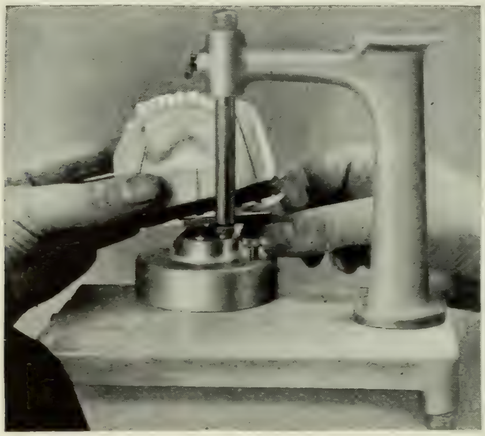


Fig. 211.

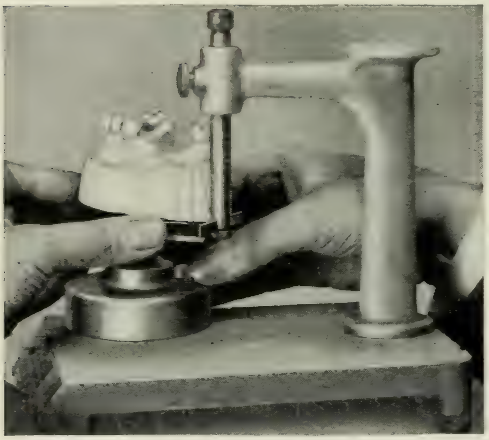


Fig. 212.

"Place the survey table upon the floor of the Clasp Surveyor, loosen the angle adjustment screw (H in Fig. 207) with one hand,

and tilt the table with the other, until the bisecting line upon the back of the cast (B in Fig. 209) appears to be parallel with the edge of of the carrier (Fig. 211) when sighted against it. Tighten the angle adjustment screw.

"When the axes of the abutment teeth are parallel, as in Fig. 213, either in a lateral or in an anterior-posterior direction as in Fig. 212, the survey table is adjusted so that either one of their axial lines is parallel with the edge of the carrier, either in a lateral, or in an anterior-posterior direction, or both, as the case may be.

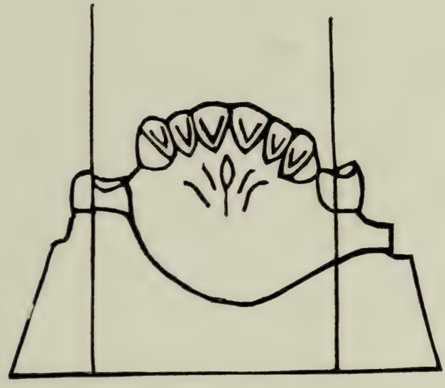


Fig. 213.

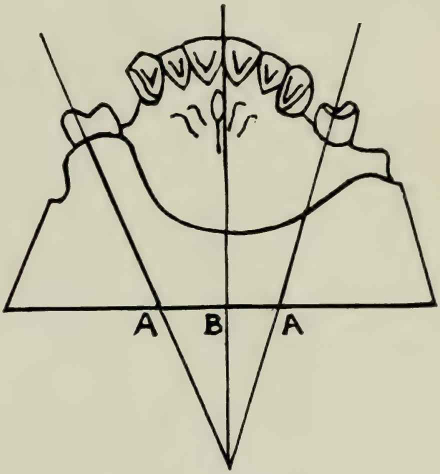


Fig. 214.

"When the abutments converge or diverge to an equal degree, as in Fig. 214, the cast will be level, when the survey table has been adjusted so that the bisecting line is parallel with the edge of the carrier. Only if the axial lines of the abutment teeth converge or diverge unequally, will the cast be tilted at an angle, when the survey table has been adjusted.

Tracing Guide Line for Clasps.

"Place one of the graphite indicators (I in Fig. 207) in the slot of the squaring tool (J in Fig. 207), and file each end in turn flush with the beveled end of the tool, as illustrated in left hand corner of Fig. 215. Insert the indicator in the slot at the lower end of the carrier, securing it by tightening the knurled screw (E in Fig. 207).

"Place one hand upon the head of the standard of the Surveyor (B in

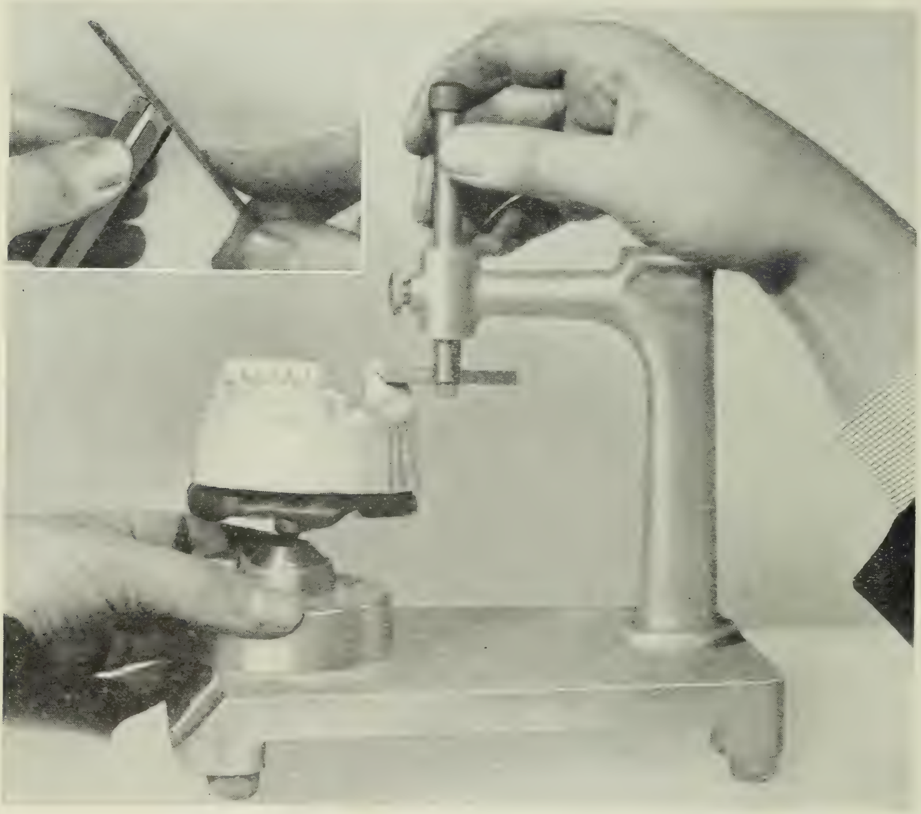


Fig. 215.

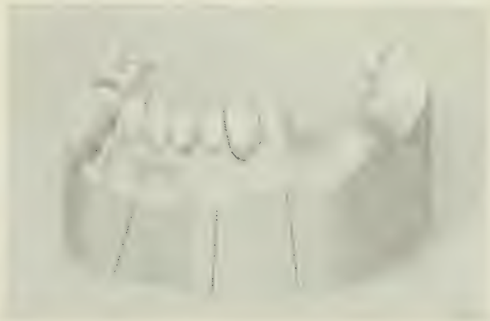


Fig. 216.

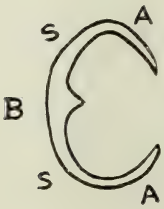


Fig. 217.

Fig. 207) so as to adjust the vertical position of the indicator and, with the other hand, move the survey table on the floor of the instrument, until the beveled edge of the indicator is brought lightly into contact with one of the teeth to be surveyed (Fig. 215). Move the survey table gently about on the floor of the instrument so that the edge of the indicator traces a line upon each tooth in succession (Fig. 215).

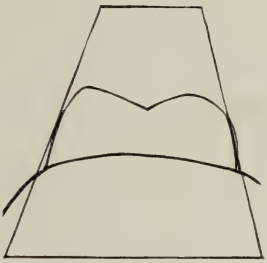


Fig. 218.

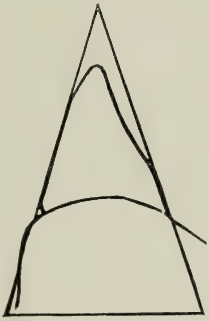


Fig. 218A.

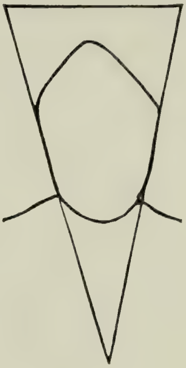


Fig. 219.

"When the tooth is conical in shape, or where it leans away from the edge of the indicator, the line traced by the latter will coincide with the gingival margin, and the point of contact with the tooth will be at the lower edge of the indicator. When the tooth exhibits a normal contour, or where it leans towards the edge of the indicator, the line traced by the latter will be above the gingival margin, and the point of contact will be nearer to the center of the edge of the indicator. The line traced by the indicator upon the surface of each tooth is the guide line for each clasp. The carrier should be oiled occasionally and talcum powder sprinkled upon the floor of the instrument, to facilitate the movement of the survey table over its surface.

"When surveying plaster or investment teeth, be sure to apply the beveled surface of the indicator to the teeth. The sharp edge will scrape the surface of any but artificial stone, or metal teeth.

"When an interdental space is too small for the approximal surface of an abutment to be properly surveyed, the adjacent tooth may be removed from the cast. Separate the two teeth with a fine saw, sawing half-way across the tooth of the gingival margin.

"When the adjacent tooth has been broken off, the edge of the indicator may be conveniently applied to the approximal surface of the abutment tooth (Fig 216). The broken tooth may afterwards be replaced with cement or sticky wax.

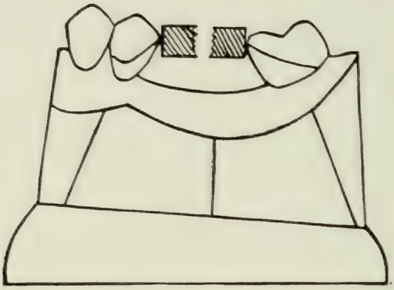


Fig. 220

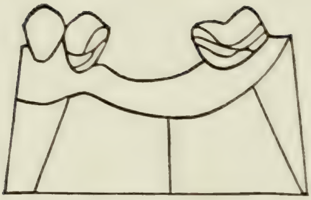


Fig. 221.

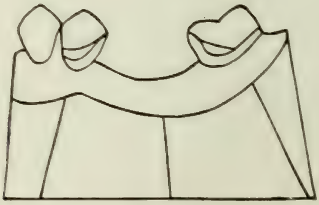


Fig. 222.

Structure, Position and Direction of Clasps.

"The diagram (Fig. 217) shows the five parts into which every definitely designed clasp may be divided. (B) represents the body or center of the clasp, the rigid point at which it is joined to the denture. (SS) represent the rigid or semi-rigid shoulders, which support the flexible, resilient and tapering arms, (AA). Each of these parts has a distinct mechanical function, and must occupy a specific position in relation to the guide line.

"When a tooth is conical (Fig. 218 and Fig. 218A) the guide line, as the greatest circumference of the tooth, coincides with the gingival margin, and retention is impossible. The available opposing enamel surfaces are inclined in planes: there is nothing to 'grip,' nothing to resist the movement of the clasp in an occlusal direction, and any increase in the tension of the clasp by 'tightening' it only increases the tendency of the denture to spring away from the soft tissue.

"When the tooth has a normal contour, opposing enamel surfaces that converge towards the cervix are available. These opposing surfaces act upon the principle of the wedge (Fig. 219), the planes of which, diverging towards the occlusal surface, tend to resist any movement of the clasp in an occlusal direction and to keep the denture in its seat. On the other hand, these inclined planes may tend to make the clasp slip towards the gingival margin. Retention is most effective, therefore, when the body of the clasp is extended in the form of an occlusal rest, above the guide line, and on to the occlusal surface, the resilient arms engaging the tooth below the guide line. The body and the arms of the clasp must touch the tooth, but the shoulders need not do so. The body is rigid; the shoulders rigid or semi-rigid, and wherever they are extended below the guide line, there must be enough space between them and the tooth to clear its height of contour, when the clasp is seated or removed. The arms of the clasp may touch the tooth below the guide line, because, being resilient, they can spread apart as the clasp is seated or removed. To prevent too much spreading, however, and subsequent deformation or fracture, they should not be located too far below the guide line. Two millimetres below will provide ample retention.

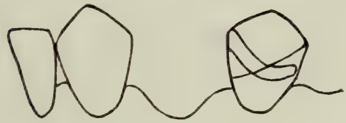


Fig. 223.

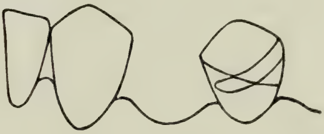


Fig. 224.

"The diagram, Fig. 220, shows the guide line traced upon a bicuspid and molar. Fig. 221 shows the location of a round wire clasp upon the bicuspid and molar. Retention is not obtainable at the distal angle of the molar, because of its mesiolingual inclination, but may be found at the mesial angle, just beyond the shoulder of the clasp. Clasp arms are frequently extended, as with the molar in Fig. 221, to enamel areas that afford no retention, so as to aid in bracing the denture against tendencies to lateral displacement.

"The diagram, Fig. 222, shows the correct location of a cast clasp upon the bicuspid, the lower edge of the buccal clasp arm two millimetres below the guide line, the shoulders and body of the clasp above the guide line. The molar displays an incorrect cast clasp design. The body is extended into the undercut formed through the mesial inclination of the molar, and defined by the guide line; it would be impossible to seat the bridge without grinding, and possibly mutilating the retention that is obtained just beyond the buccal shoulder of the clasp.

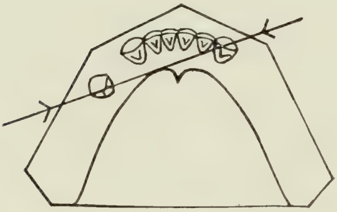


Fig. 225.

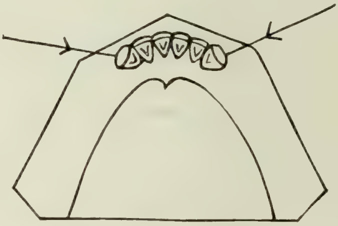


Fig. 226.

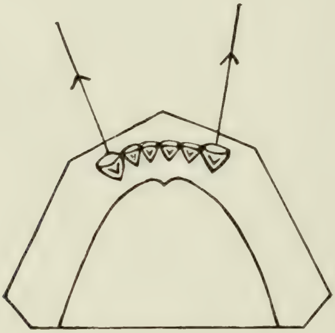


Fig. 227.

"When an abutment tooth is isolated, with a free space on either side (as in Fig. 223) the clasp may frequently be joined to the denture upon either the mesial or the distal surface. If the tooth leans in a distal direction (as in Fig. 223), more effective retention may be obtained at the distal angles, in which case the body of the clasp is located mesially, with the clasp arms pointed in a posterior direction. When the reverse is the case, better retention may be obtained by pointing the clasp arms in an anterior direction (as in Fig. 224).

When the tooth leans, so that the guide line is not level, better retention may be obtained by charting the clasp in such a direction that the clasp arms engage the tooth where the guide line is farthest from the gingival margin, and joining it to the denture where the guide line is nearest to the gingival margin.

Factors in Clasping Anterior Teeth.

"A labiolingual grip upon cuspids or other anterior teeth seldom provides retention, because the mesial and distal surfaces of anterior teeth converge towards the cervix so as to permit the wedge principle to operate (Fig. 225).

"When it is impossible to engage the mesial surface of an anterior tooth, owing to the proximity of the adjacent tooth, the opposing and reciprocal grip, necessary for clasp retention, may be obtained if there is a posterior tooth that is not conical in shape (as in Fig. 225). The arrow line indicates the direction of the converging tension of the clasp arms. Under these conditions, it is advisable to locate the rigid body of the clasp upon the mesial, or lingual surfaces of either tooth, so as to resist any orthodontic action that might arise through the converging tension of the clasp arms.

"When no posterior tooth is present, and it is impossible to obtain a mesiodistal grip upon two cuspids, the labial clasp arms will sometimes provide retention, if the teeth are turned sufficiently for their labial surfaces to face each other and the direction of the converging tension of the clasp arms is approximately that of the arrow line in the diagram Fig. 226. The body of each clasp should, of course, be located upon the lingual surface to resist this converging tension.

"If two cuspids are so turned that their labial surfaces face in the same direction (as in Fig. 227), and no mesiodistal grip is possible, the action of the clasp arms, in the direction of the arrow line, may tend to unseat the denture and clasp retention will be impossible."

CHAPTER XV

Clasps and Wire Bending

Clasps are of varying types and no one type of clasp is universally useful. In the following chapters we will describe the clasps which come under each type and their uses.

The round wire clasps stand at the head of the list. The next most useful is the Jackson crib, which is a combination of the round wire clasp and the matrix clasp. Next comes the matrix clasp, then the flat plate and finally the cast clasp.

I believe it is best to lay down some general rules for the methods of bending wire and to describe the instruments used in these methods, together with gauges of wire used.

Wire for Clasps.

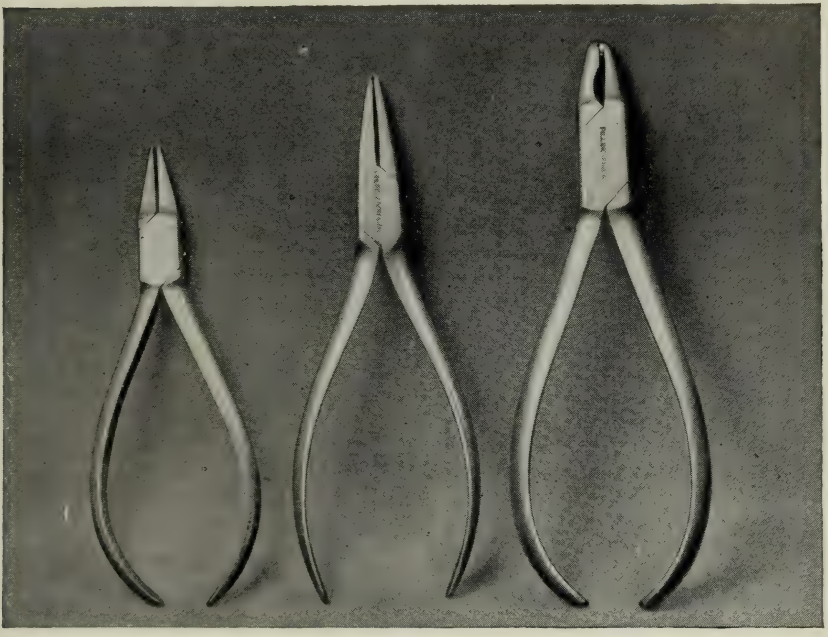
I use wires varying in gauge from 15 to 21. I never have believed it to be good economy to use a cheap grade of clasp metal. I have always bought the best, as the saving in cost when using cheaper grades is always offset by the necessary repairs. Any reputable company will tell you the content of their wires and the ones to use for a particular purpose.

I have bent all of the wires of the best companies and see very little difference in their working qualities. As far as breakage is concerned, I have kept no records, and even if I had, I do not believe any conclusions could be drawn, as some patients are very careless with their dentures. A good wire, used by a careless person might mislead us into believing it to be a poor wire. I have had laboratory men complain of the quality of the wire selected by me and have later found that it was their technique that was faulty. The Bureau of Standards can easily determine for you the breaking points of wire. A letter to them would bring you their findings.

In my list of round wires, I use 18, 19 and 20 gauge for the Jackson crib. The matrix portion is made of pure gold, 36 gauge. With the Jackson crib clasp, a great deal depends upon the space we have at the contact point of the teeth to be clasped. Finer wire is used where the space is narrow. Heavier wire must be used with surgical appliances, such as obturators and prosthetic replacements of the maxilla. Gauge

15 and 16 wire is used to connect a clasp to the bars or other parts of the appliance. Heavier wires may be used for this purpose if the dentist wishes.

For ordinary round wire clasps I use 17, 18 and 19 gauge, according to the location of the tooth to be clasped, and the character of the denture, paying considerable attention to the stresses to be applied. That is, I would use a very much finer wire in a delicate woman's mouth, than I would in the case of a strong man. The same thing holds true of the character of the teeth to be clasped. Firmly rooted teeth will endure a heavier wire than a loose one.



A. B. C.

Fig. 228. Pliers; A. Peeso; B. Aderer and C. Nesbett.

Wire Bending Pliers.

There are three good methods of bending wire. They are cold wire bending, hot wire bending and swaging. These are mentioned in the order of their importance. Cold wire bending is the ordinary bending of wire with pliers. I try to keep my list of pliers as small as possible.

I use three pliers (Fig. 228); the Peeso collar pliers made by S. S. White Co. (Fig. 228 A and Fig. 229), the Aderer wire bending pliers No.

77 (Fig. 228 B and Fig. 230) and the Nesbett pliers (Fig. 228 C, and Fig. 231) manufactured by Pilling & Company. The selection of pliers is a matter of choice and I would advise any student to learn to use the instruments that are at hand or in the college requirement list.

I have taught many students to bend clasps and have also had many poor workmen who tell me they could not use this or that instrument as it was not like the one that their former preceptor had. I have always felt like Benjamin Franklin did, when a bad workman quarreled with his tools, and reminded them of the story of Michel Angelo. When one of his students complained that he could not paint a picture because his brushes were not as good as the Master's he asked the student to hand him his poorest brush and immediately painted most beautifully with that one.

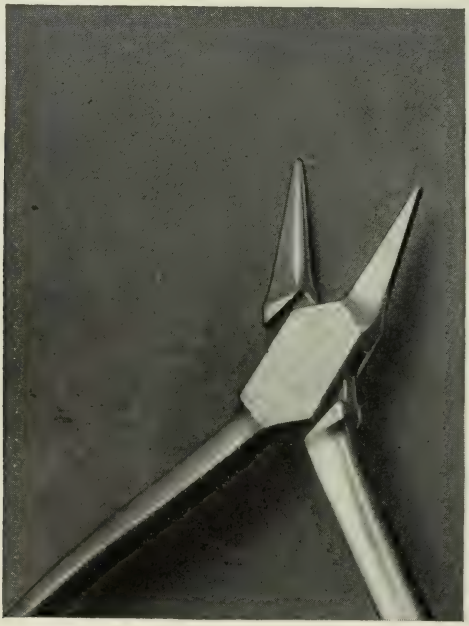


Fig. 229. Peeso pliers. Note the curved and flat beak.

I do not mean that a round wire clasp could be bent with a pair of gas pliers, but I do believe that we should study the instruments and select the one that is the most universal in its uses. If we look at the Peeso pliers, (Fig. 229) we may note that the beaks are narrow, tapering to a gradual point, one of the beaks being flat and the other round. The round beak should be placed on the inner side of the clasp. If we bend the wire too far, the flat beak can be placed on the inside, the pliers closed and the wire will straighten out. This is a beautiful instrument, and we should practice with it on pieces of German silver wire, until we have tried out all its uses.

The Aderer pliers (Fig. 230) has a groove in the end, which greatly assists us in holding the wire; especially if we are bending the clasp up, or down, out of the horizontal plane. One beak is round and the other is flat, like the Peeso pliers, but has not so great a taper or curvature. Care should be taken to grasp a clasp at some point so that it is not distorted by the pliers when we squeeze upon them to get a tight grip. Then the Peeso collar pliers are used to bend, in an upward and downward direction.

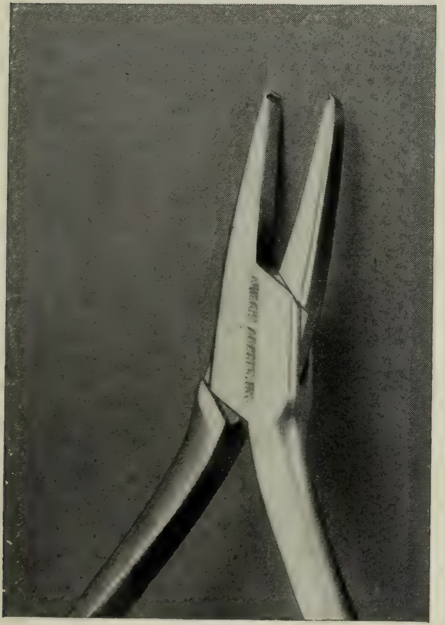


Fig. 230.

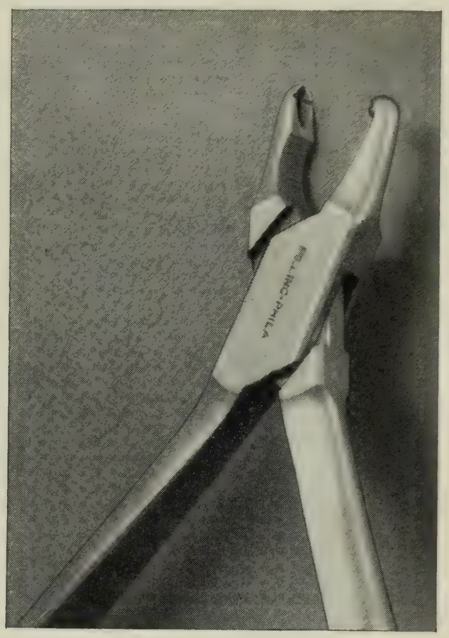


Fig. 231.

Fig. 230. Aderer pliers. Flat and curved beak. It has flatter beaks than the Peeso pliers.

Fig. 231. Nesbett pliers. Note alteration in pliers by grinding socket and notching the ball.

The Nesbett pliers (Fig. 251) are very useful in bending the center of the wire without distorting the ends. It has a ball on one point of the pliers and a socket on the other, into which the ball fits. These pliers are useful in bending Jackson cribs, and are a modification of the original Herbst pliers, which were used for that purpose.

These Nesbett pliers should have the beaks altered. The ball should be cut with a cross-shaped cut to hold the wire, and the socket should be made egg shaped, as shown in Fig. 231. While this is not important for wire bending, it is important when we come to the flat clasp bending. This alteration is made by means of grindstones.

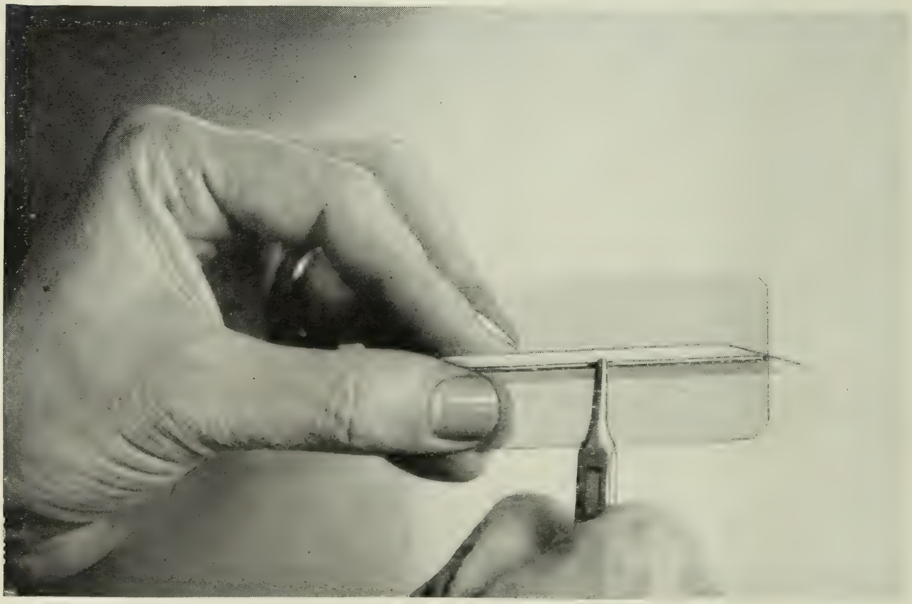


Fig. 232. Method of holding pliers when bending wire in the horizontal plane. The crossed pieces of celluloid are for illustrative purpose only.

Wire Bending Methods. A piece of wire can be bent into any other plane from that in which it originally lies, without distorting the wire which lies in the original plane, if the following method is used.

Let us undertake to bend a piece of wire to assume the shape of a right angle. Hold the pliers at a right angle to the plane in which we wish to bend the wire; (or parallel with the plane from which the wire must turn;) then turn the wrist until the wire assumes the desired shape. In the illustrations the crossed pieces of celluloid are used for illustrative purposes only, and indicate the horizontal and the vertical planes. In Fig. 232, the wire lies in the horizontal plane;

the pliers are at a right angle to this plane, and parallel with the vertical plane. Turning the wrist will bend the wire so that the bent portion will be at a right angle to the vertical plane, whereas in Fig. 233, the reverse is true; the pliers are at a right angle to the vertical plane, and parallel with the horizontal. Hence turning the wrist will bend the wire so that the bent portion will be at a right angle to the horizontal plane. Let us state this in another manner.

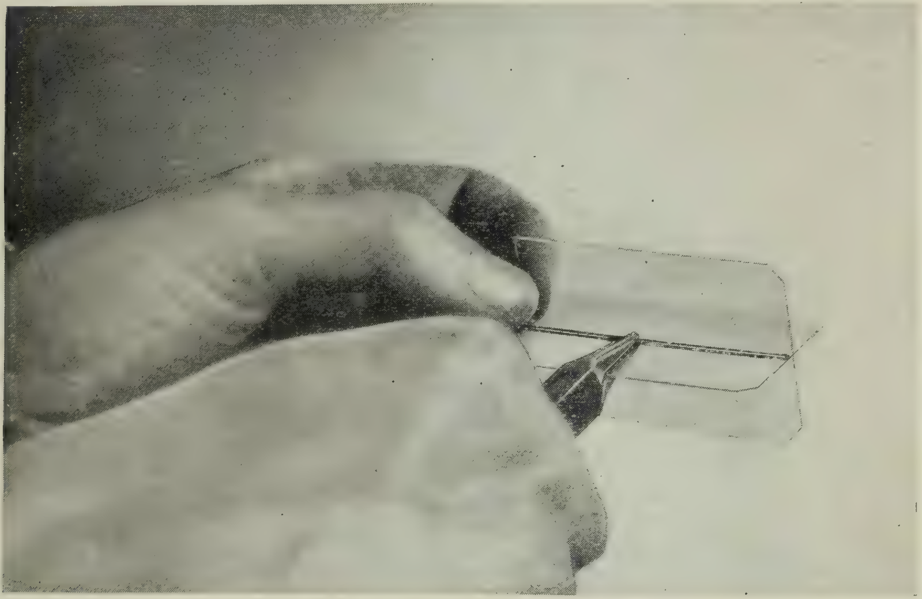


Fig. 233. Method of holding wire when bending wire from horizontal to vertical plane.

Take a piece of straight wire and lay it on the page of this book. If we hope to bend this wire into a square which lies in the same plane as this page in the book, the pliers must necessarily be held at right angles to the page. If we held them at any other angle to the page, the ends of the wire would be distorted from the proper plane. If we want to bend the end of a wire in a plane of 45 degrees, then the pliers should be held at an angle of 45 degrees to the page of the book, or at right angles to the plane to which we intend to bend the wire.

Importance of Annealing. At no time should a wire be bent unless it is first thoroughly annealed. Long practice tells us when the wire begins to work hard, but it is always safer

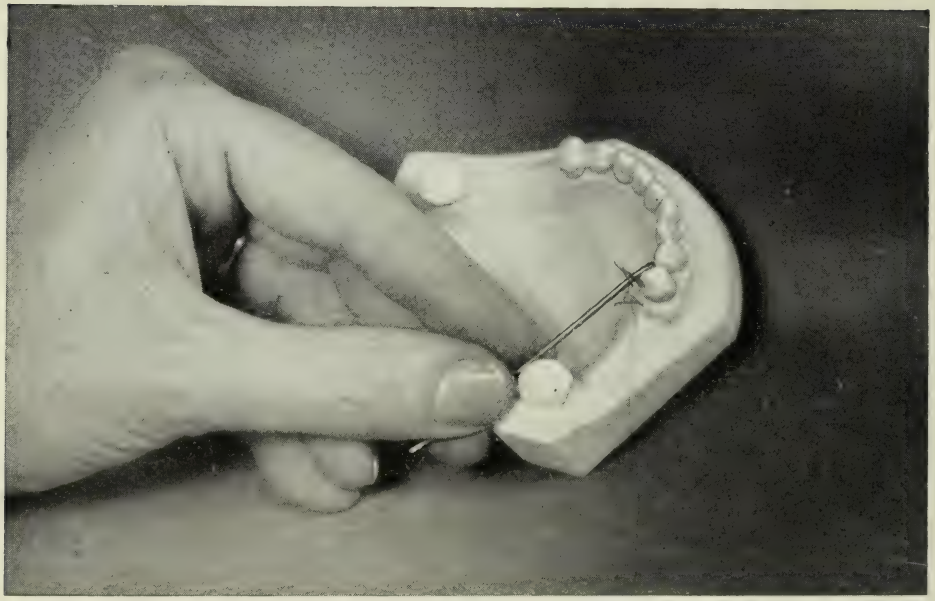


Fig. 234. Starting a clasp. The end of the wire should be placed against the outline of the clasp where it is terminated on the lingual side.

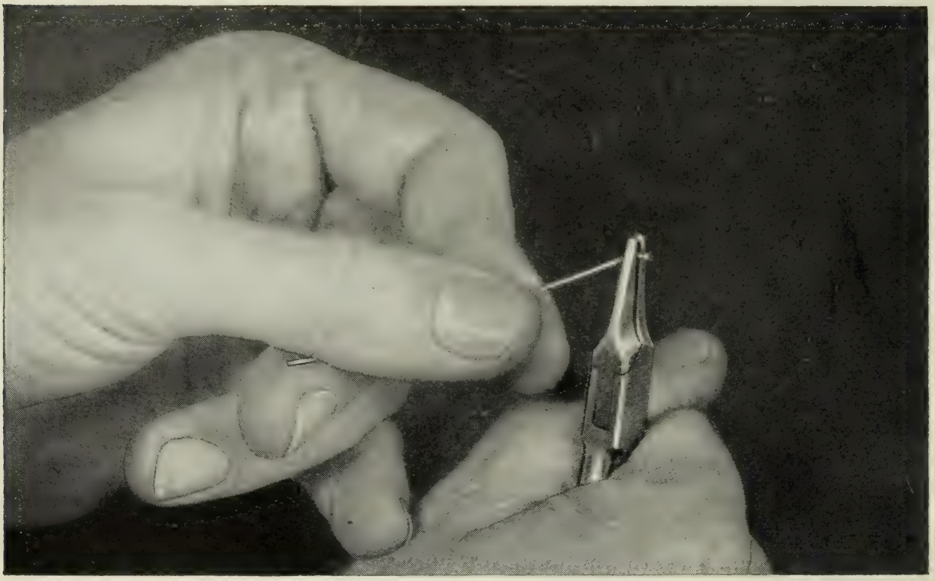


Fig. 235. The first bending is done with Peeso pliers, the rounded beak being placed against the inner side of the bend.

to anneal the wire after each bend. The wire is heated in a Bunsen burner, until it assumes a cherry red color. It should not be held still in the flame, but should be moved back and forth, to distribute an even heat, and it should be plunged into cold water when it reaches the cherry red stage, or 1000° Fahr. When it is cooled, it is ready for bending.

If at any time we bend the wire too far, and desire to bend it back, to straighten it out, we should be very careful to anneal the wire at this point, as otherwise we may start a fracture. We should also see that the beaks of the pliers have no sharp edges on them, which would nick the wire and start a fracture.

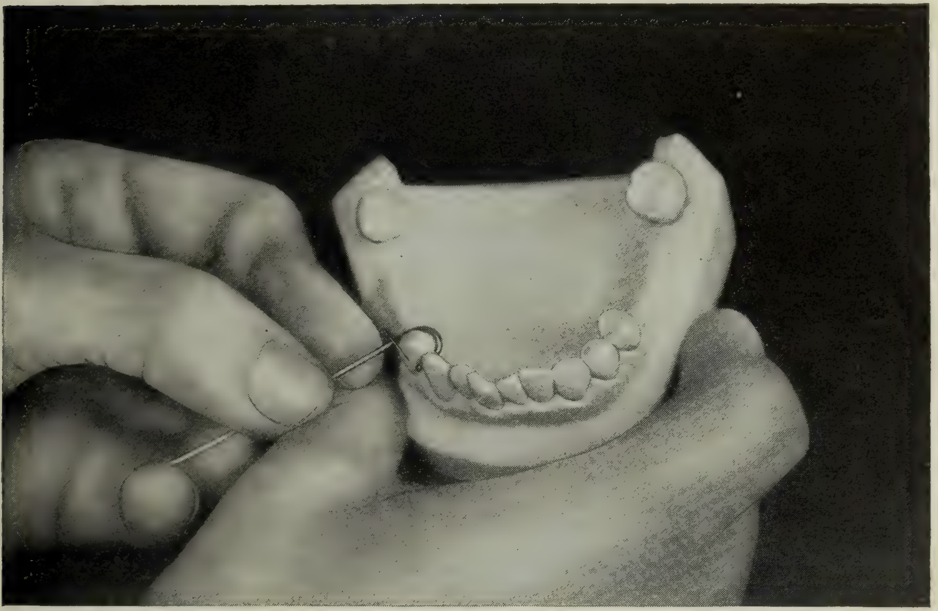


Fig. 236. Placing the wire on the clasp outline to see where it leaves the outline. Where it leaves the outline it is marked for the next bend.

Round Wire Clasp Bending.

In bending a wire clasp around a tooth, we should start on the lingual side and work around towards the buccal side. This gives us a length of wire to grasp and when we cut the wire, we shall need to cut from one end only, which is much less wasteful of clasp metal, than if we began at the middle and bent towards the ends. Likewise, if we begin at the middle and bend toward the ends, should we have a surplus of wire when we do adjust our bending on the lingual side, this surplus will strike the adjoining teeth, and will prevent us from making the bend accurately. The wire should be rounded on one end so that there are no sharp edges to annoy the tongue. This end should be placed on the outline where it terminates on the lingual side against the tooth (Fig. 234)

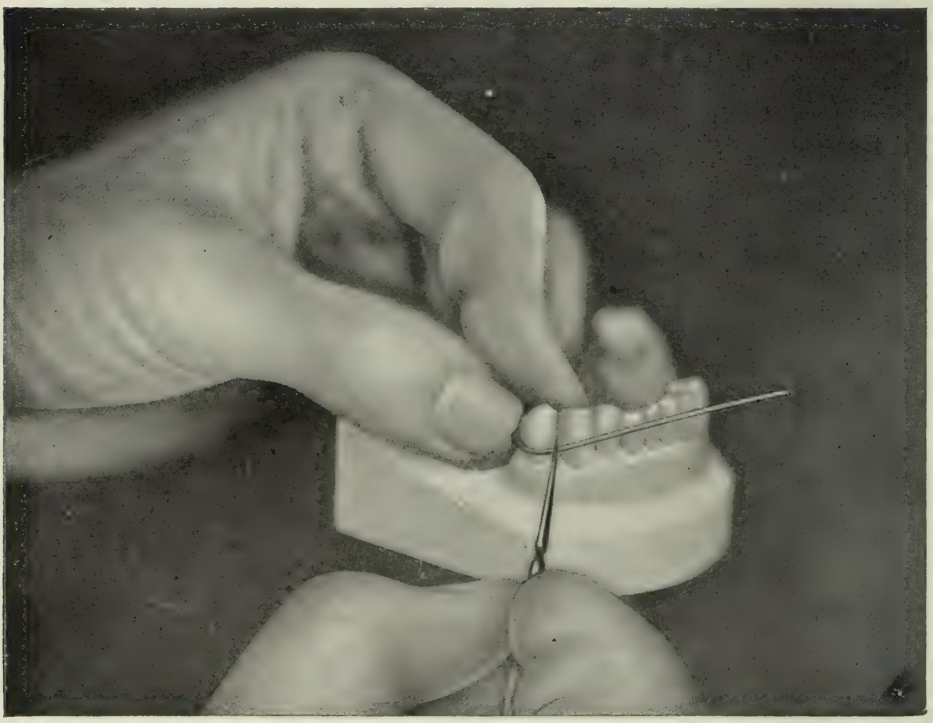


Fig. 237. Marking the length of the clasp.

and the point noted where the wire leaves the surface of the tooth. It should be grasped with the Peeso pliers at this point, the curved beak placed on the inside circumference with the pliers held at a right angle to the plane we are bending in. With a twist of the wrist, the wire is bent into the plane which we intend it to occupy. (Fig. 235.)

The wire should then be annealed, dipped in water and laid upon the outline, and the point where it again leaves the surface of the tooth noted. (Fig. 236.)

This process must be repeated as many times as may be necessary to get the clasp into its proper shape on the outline. In the first two or three bendings, it will be necessary for us to turn the pliers but wherever it is

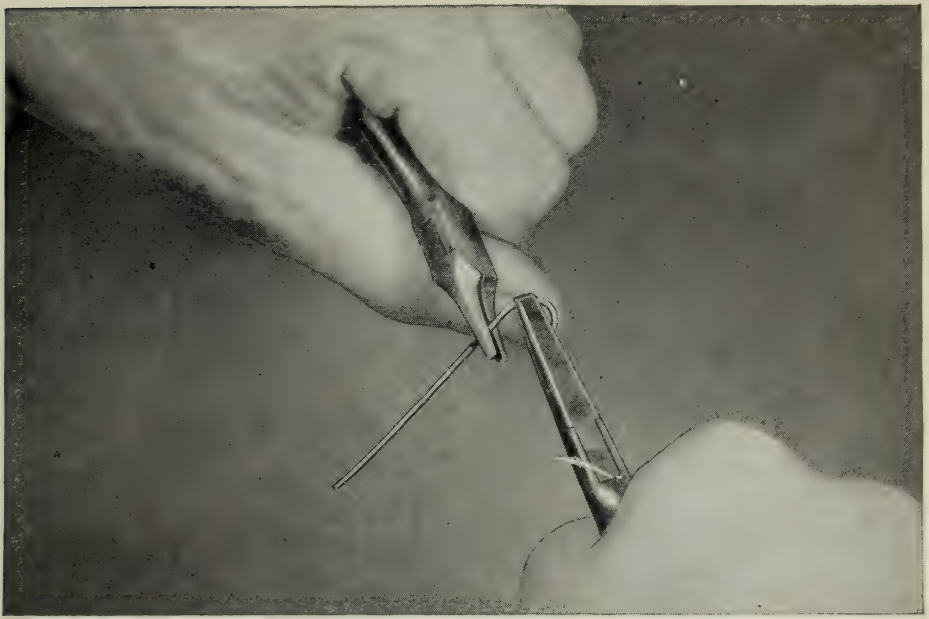


Fig. 238. Holding with the Aderer pliers and bending with the Peeso pliers.

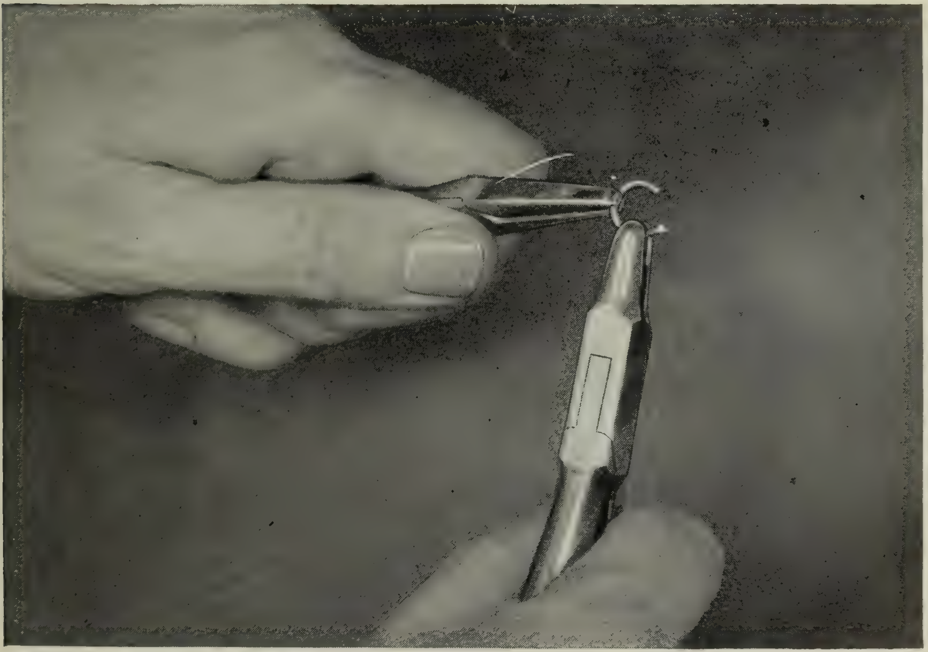


Fig. 239. Holding with Aderer pliers and bending with the Nesbett pliers.

possible, it is best to hold the pliers still and bend the long end of the wire with the fingers, as in this manner you will be much less liable to break the wire.

As we approach the buccal end of the clasp, we can judge the length of the wire to be used and mark it (Fig. 237), cut it off with a pair of cutting pliers, and complete the bending of the buccal end with the Peeso or Nesbett pliers, holding it with the Aderer pliers. (Fig. 238.)

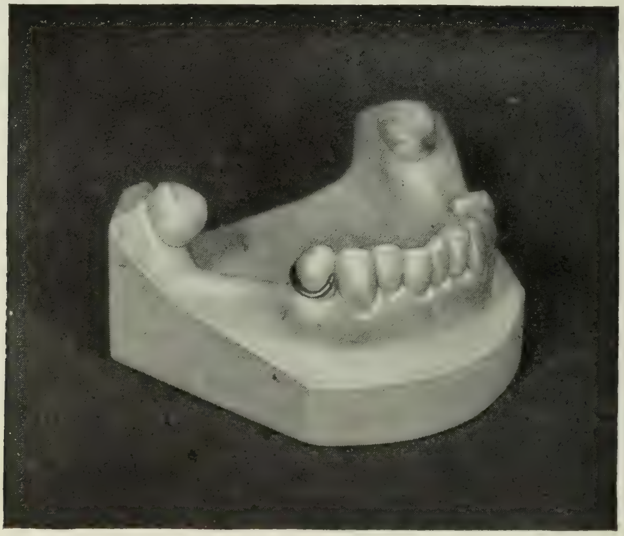


Fig. 240. Finished clasp.

The buccal end is then nicely rounded with stone or sandpaper disk and polished with a Burlew disk. Burlew disks are made of rubber, incorporated with pumice. They can be purchased from the supply houses.

Sometimes after the clasp has been bent, it becomes necessary to get a little more curvature in the wire. We can then take the Nesbett pliers and make this bend without unduly distorting the clasp. (Fig. 239.) The finished clasp is shown in Fig. 240.

Any attachments to the clasps should be made and soldered with a high karat solder.

The Bureau of Standards and all manufacturers of clasp metal, advise retempering of gold after the work is finished. To do this we place the gold in a furnace which has a thermometer attached, and raise the temperature to 900° F. and hold at that temperature for 10 minutes,

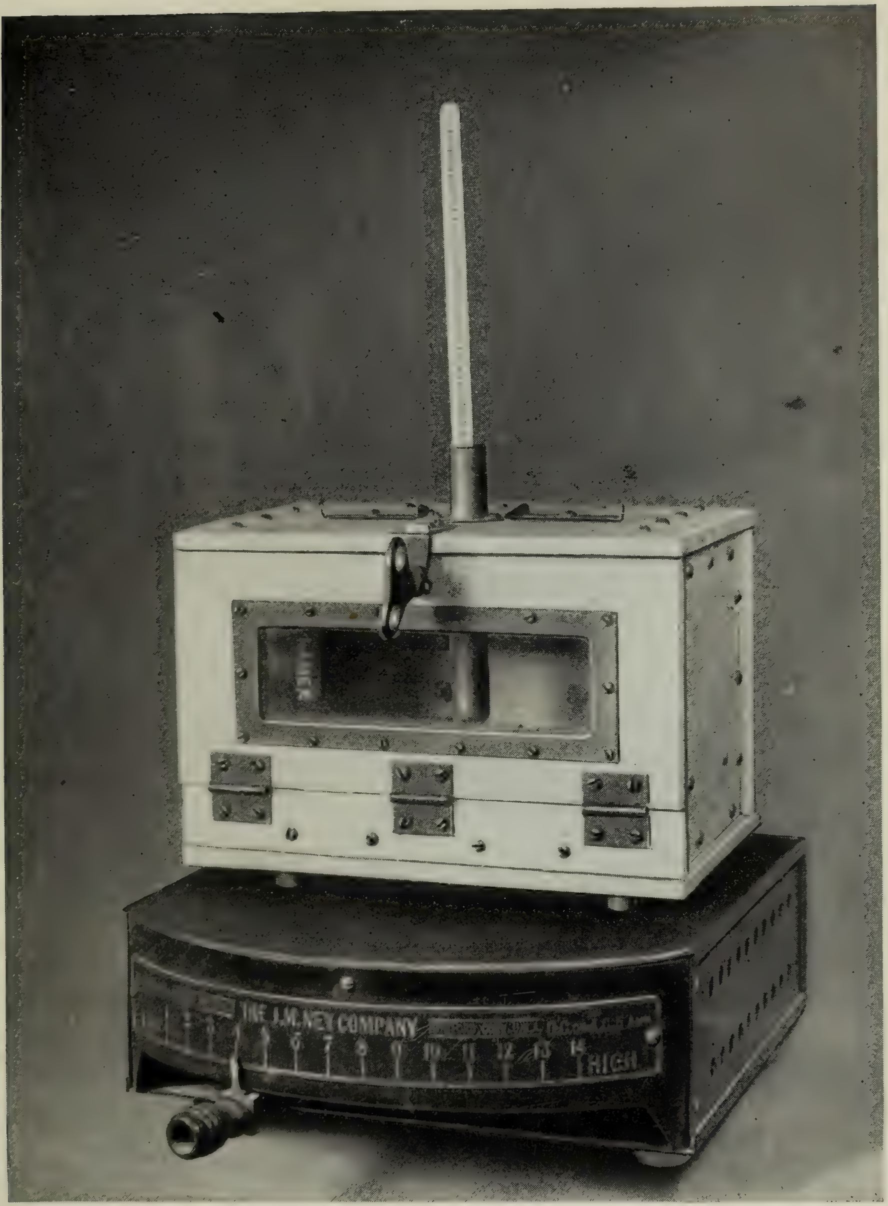


Fig. 241. Tempering, and drying out furnace.

then allow to cool off to 400° F. A satisfactory furnace for this purpose is one manufactured by the J. M. Ney Company, and it can also be used for drying out models (Fig. 241). They have two types. It is claimed that the tensile strength is raised one-third by this method. The current is turned off and the apparatus allowed to cool.

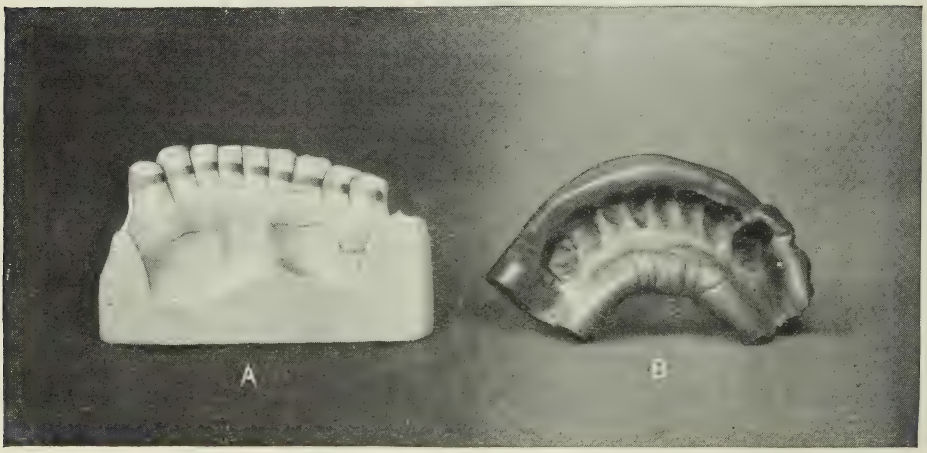


Fig. 242. A. Original cast. B. Paraffin wax impression from original cast.

It is not necessary to buy an expensive furnace for this purpose. A can lined with asbestos, can be placed over a Bunsen burner and very good results obtained, provided we place a thermometer in a hole in the side or bottom. This method though is not as accurate as if we use a furnace.

A method of bending wire, which is coming into prominence, especially amongst the orthodontists, is hot wire bending, (I believe Dr. L. J. Porter of New York is the originator) and for this purpose we must use a special wire, which both the Ney and Aderer companies manufacture. It is seldom necessary to resort to hot wire bending unless we have a complicated piece of bending to do. This will not occur in the ordinary clasp, but sometimes does occur in the continuous clasps.

Technique for Extra Cast.

The method requires the making of an extra cast, (Fig. 242 A). To obtain this cast, take some pink paraffin wax and heat it so that it is warm throughout; then take an impression from the original working model, (Fig. 242 B). We need only to take an impression of the teeth which are to be clasped. This may be done either by having a bridge impression-tray hold the wax, or by having a sufficiently large roll of wax to press against the working model without distortion. The best method of doing this is to heat the wax throughout, and press it upon the model with the fingers. Then lift it off, chill it and reheat the surface of the wax which comes next to the teeth. The stiff outer wax will act as a matrix for the softer inner portion which is forced between the interstices of the teeth and produces a very sharp impression.

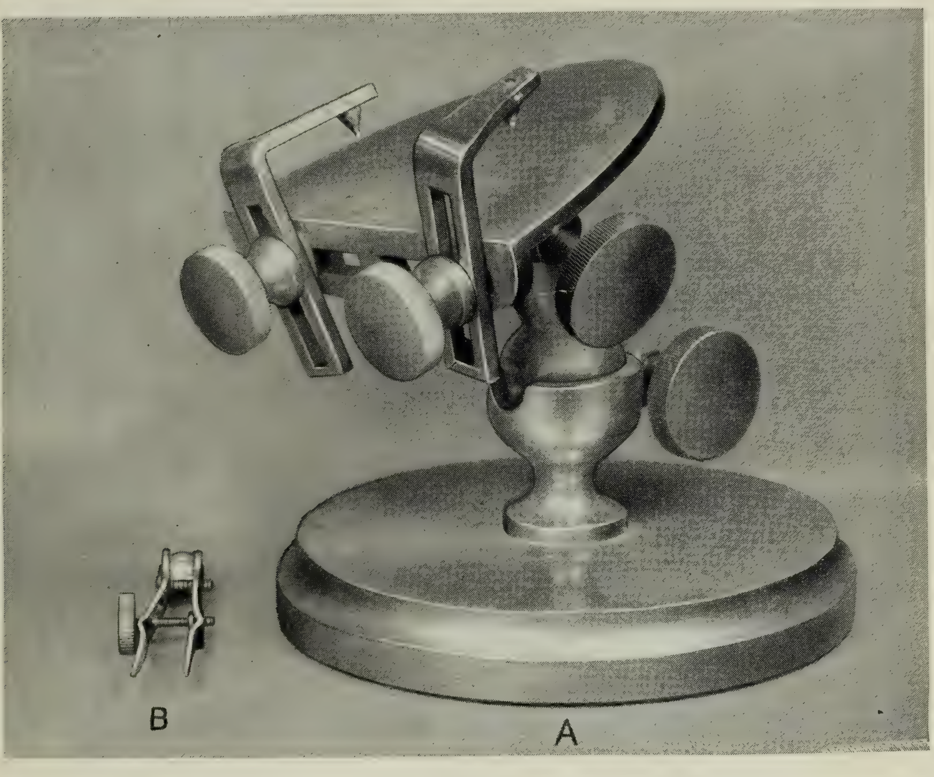


Fig. 243. A. Tilting table used for holding casts when bending wire, soldering, etc. B. Extra clamp for holding wire against tooth.

I have tried a number of waxes and find that the pink paraffin is the best. Into this pink paraffin wax impression, we pour impression plaster, mixed with a considerable quantity of salt, so that it will set quickly. Thoroughly stir the impression plaster until it can be picked up with the fingers and made into a roll. We must work very rapidly and actually push the plaster into the impression with our fingers. As soon as it sets, which takes about two minutes, we can dissolve the pink paraffin wax from the cast by pouring hot water over it, and we are ready to begin our wire bending.

The outline of the clasps is drawn on the duplicate cast in imitation of the one on the original model.

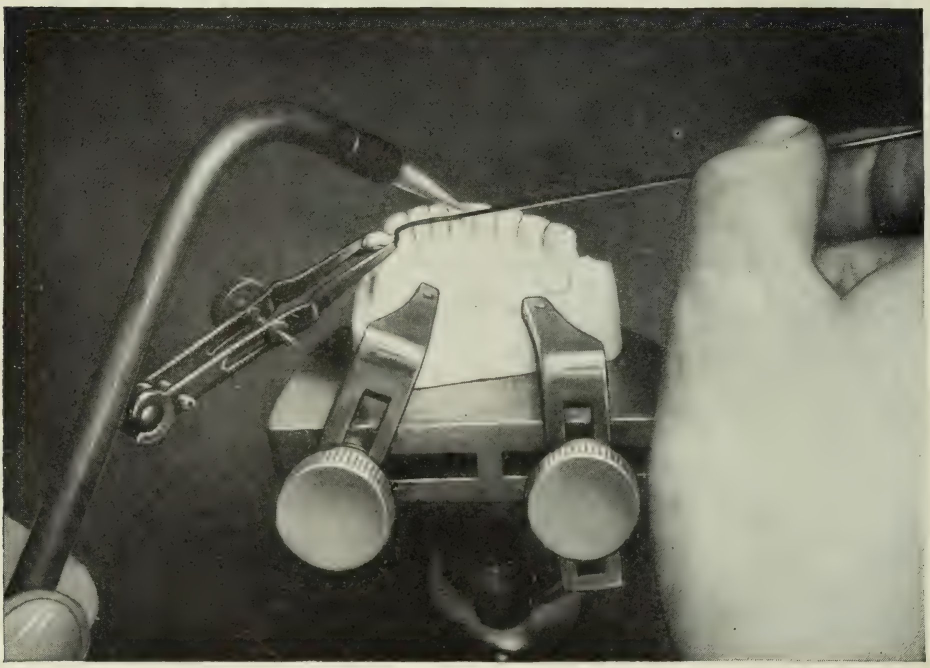


Fig. 244. Use of blowpipe in hot wire bending.

Technique for Hot Wire Bending.

We use a little tilting table, (Fig. 243 A), designed by Dr. Ernest N. Bach of Toledo, Ohio, and manufactured by the Blue Island Specialty Company, to do our bending upon. This tilting table has two clamps for holding the cast. An extra clamp will be needed for holding the clasp wire to the cast. (Fig. 243 B.) The cast is clamped to the tilting frame, and we start bending the wire with a pair of pliers, and clamp it in proper place on the cast.

Then a blowpipe is taken in one hand, and the long end of the wire in the other, and we heat the wire at the next point where we intend to bend it (Fig. 244). When it begins to redden, we press upon the wire in the direction of the cast, and the hot wire will shape itself to the cast. By dexterously pulling and pushing against the wire, it can be made to follow the shape of the teeth with great ease, after the technique has been mastered. It is seldom necessary to use an instrument to push the wire into place, but if one is used, we must be careful not to mar the cast, nor the wire. The best tool for this purpose is a slate pencil, properly grooved, so that it will grip the wire. This groove can be made on the end of the slate pencil with a small, round file.

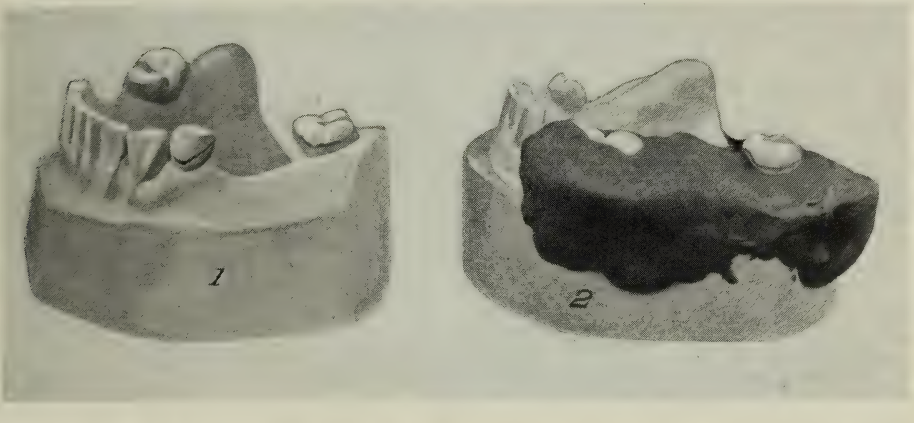


Fig. 245. No. 1. Working cast marked for clasp. No. 2. Moldine built over cast.

Sometimes it is an advantage to move the clamp closer to the point where we are bending. It will require some skill to learn this method but it is a great saving in time. It is best to try to bend the wire without the use of any implement to push it against the cast, as it is easy to mar the cast, and the bending can be done by just pressing against the wire and properly applying heat.

This wire should be treated the same as any other wire, that is by annealing it and finally tempering it in the furnace. The final twists and turns can be placed in it with a pair of pliers. The cast will develop small cracks on the surface, due to the flame of the blow pipe, but it will not fall apart, and, as it is discarded as soon as the wire is bent to the proper shape, one need not worry about this.

Technique for Swaging Wire Clasps.

Another method of bending wire, is by swaging, but fusible metal casts are required for this purpose, and counter dies must be made to swage the wire into shape. This is advocated by some men for all types of clasp bending. I do not think it is at all necessary, as the work can be done much better, and more quickly by cold wire bending, although it may save some time in making the more difficult forms of Jackson cribs.

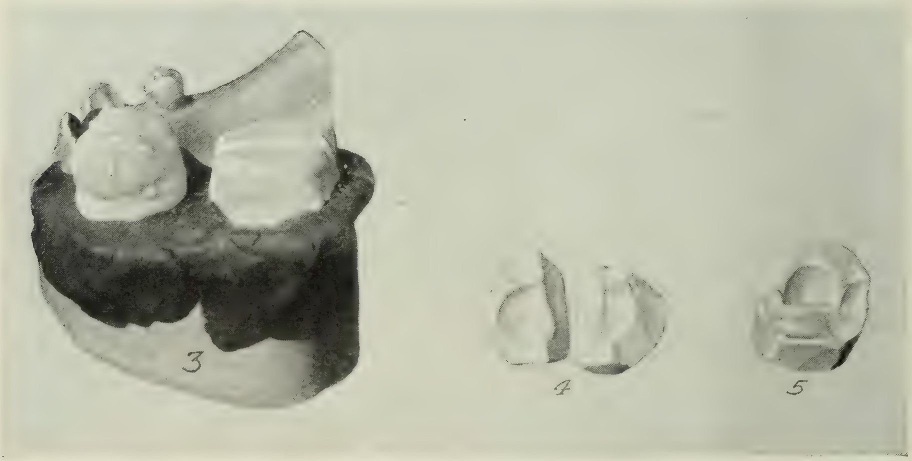


Fig. 246. No. 3. Plaster impression taken of part of tooth projecting through the moldine. No. 4. Impression split. No. 5. Impression trimmed to fit rubber ring.

Mr. George Roth of the Ney Company has worked out a technique and has kindly loaned me his illustrations. I will describe here some of the essential features.

The working cast is made and outlined (No. 1 in Fig. 245), and moldine is built upon it to 1/2 mm. below the outline of the clasp, at right angles to the surface of the tooth, (No. 2 in Fig. 245). Care must be taken that the moldine comes exactly to that point, as this is the shelf upon which the wire will rest when we do our swaging. A plaster impression is made of the part of the tooth which projects out of the moldine, (No. 3 in Fig. 246). The plaster is mixed and poured upon the surface of the moldine covering the tooth, which latter projects through it. A sufficient quantity of plaster is used to give it bulk; about three-eighths of an inch of plaster all around the tooth and above it. When the plaster is set, a groove is cut in the upper surface, and the impression is split, (No. 4 in Fig. 246). It is then trimmed so that it will fit into a rubber ring about 3/4 of an inch in diameter, (No. 5 in Fig. 246). If the plaster does not fill the ring, moldine must be used to accomplish this. The plaster is assembled and held together by means of sticky wax, the moldine fitted around it (No. 6 in Fig. 247) and the rubber ring pressed into the surface of the moldine, (No 7 in Fig. 247). The ring is then filled with a fusible metal such as Ney's Dialoy. When it is chilled, the ring is removed, the moldine separated and the impression is split from the die, (No. 8 in Fig. 247). Any slight imperfections in casting are removed and we are ready to make the counter dies.

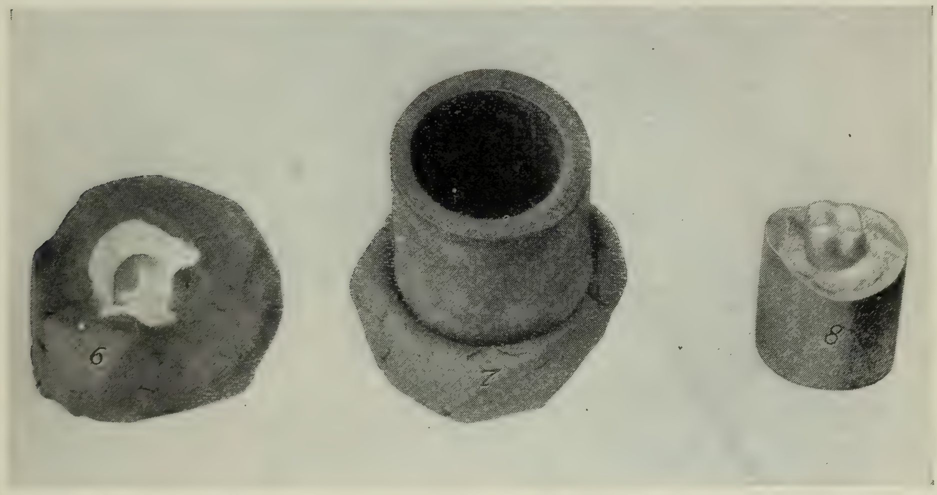


Fig. 247. No. 6. Plaster impression assembled and fastened with sticky wax, and moldine fitted around it. No. 7. Rubber ring pressed into moldine. No. 8. Impression split from die.

Construction of Counter Dies.

The counter die must contain an impression of the wire that we intend to swage, and here Mr. Roth has added a nice bit of technique. The Ney Company supplies a pattern wire of the same gauge as that which we intend to swage, but which is made of a soft metal, like lead. This is twisted in the form of a loop around the die, and the ends are waxed in place to keep them from moving. The ends are crossed over one another and twisted, (No. 15 in Fig. 248). The occlusal surfaces of the teeth are previously cut down with a file, or a hot spatula, and any bulge on the contours must be removed, or the counter die will not draw.

The soft wire and the die are assembled and held together with sticky wax. The surface of the die is covered with anti-flux, such as rouge, or whiting. (No. 13 in Fig. 248.) I prefer whiting, as it is cleaner. The die is then placed back in the rubber ring (No. 14 in Fig. 248) and the fusible metal is poured into the ring, making a counter die. When this counter die is chilled and removed from the die, there will be a groove, showing a line where the pattern wire lies, (No. 16 in Fig. 248).

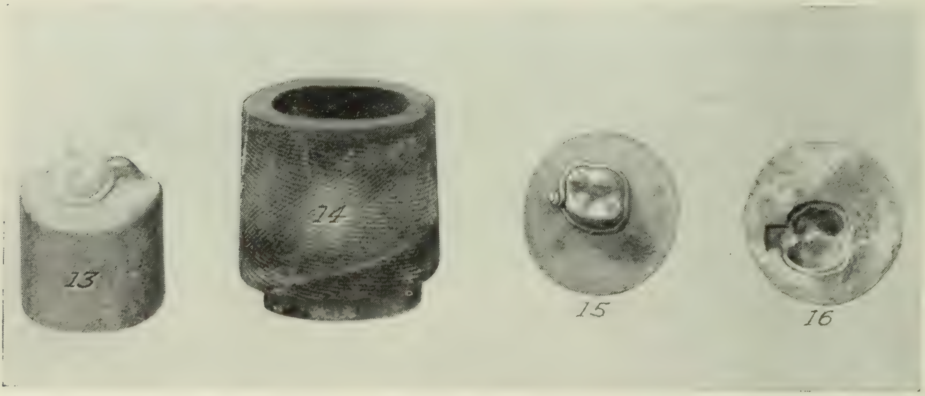


Fig. 248. No. 13. Surface of die covered with anti-flux. No. 14. Die placed back in ring, after which fusible metal is poured, making counter die. No. 15. Ends of wire crossed and twisted. No. 16. Groove where pattern wire lay.

The pattern wire is taken from the cast and cut where it is twisted upon itself. It is then used as a pattern for the length of clasp wire. The clasp wire is annealed and bent around the die with a pair of pliers to the approximate shape. It is then placed into position on the die, covered with the counter die and swaged; annealed, rebent and swaged again. Be careful to chill the wire each time you anneal it, to soften it, and also to prevent marring the die. I have seen men place hot wire on the die and have it adhere so that it was impossible to remove it without destroying the die.

When the swaged clasp is placed back upon the cast, there may be some adjustment to be made with the pliers and there generally is. It has been my experience that if a man were unskilled in bending wire, when he made these adjustments, he would throw the clasp out of shape entirely, so that it would be much better for him to

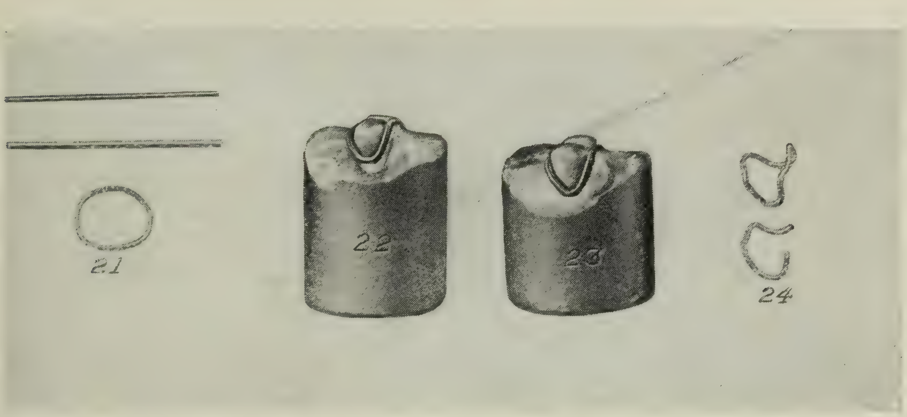


Fig. 249. No. 21. Pattern wire is cut where it crosses and ends soldered together. No. 22. Ring of clasp wire in position. No. 23. Ring of clasp wire swaged. No. 24. Finished clasp produced by cutting where the ends were soldered.

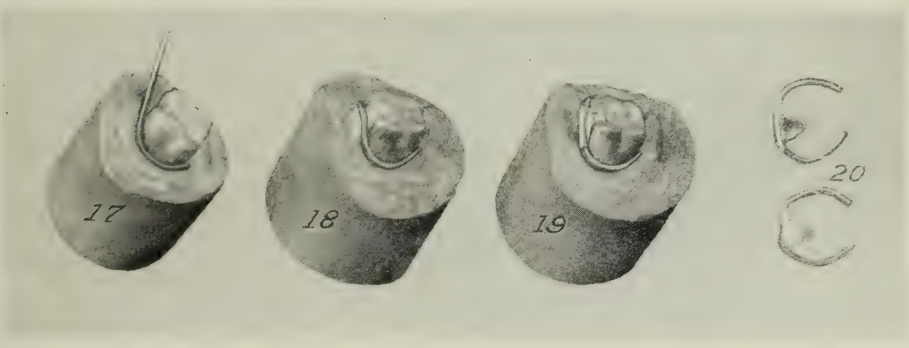


Fig. 250. No. 17. Wire bent to form resting lug and swaged on die. No. 18. Soft gold fitted into lug seat for swaging. No. 19. Wire and lug reswaged. No. 20. Pure gold and clasp united by soldering.

learn how to bend wire properly in the first instance, and he would not need the process of swaging. For some of the heavier gauge wires, however, and some of the complicated cribs, I believe this method will be an assistance to most men.

Second Method of Swaging Wire Clasps.

Another method of swaging a wire clasp is by means of the ring method. When you have reached the stage of cutting the length of wire from the pattern wire, (No. 21 in Fig. 249), it should be cut where it crosses, after which it is measured on the clasp wire, roughly bent into shape, and the ends soldered together with a high karat solder, (No. 21 in Fig. 249), or some of the Ney casting metal, (C or G). Then place this ring of clasp wire in position on the die (No. 22 in Fig. 249) and swage it to place, (No. 23 in Fig. 249). This technique can only be used with our finer gauges of wire, 17, 18, 19 and 20. When it is swaged down into place, the clasp is cut to its final length, removing the portion which was soldered. (No. 24 in Fig. 249.)

The swaging method offers another advantage and that is the placing of the lugs. Some men find them easier to swage than to burnish into place.

Technique for Swaging Lugs.

By this method the wire is bent and swaged upon the die, (No. 17 in Fig. 250) ; a piece of pure gold, 36 gauge, is placed on the die (No. 18 in Fig. 250) where we intend to make our lug; the clasp is placed into position over it, and the counter die swages it into position. The projecting piece which extends over to the adjacent tooth, if there is one, is then bent over and burnished around the wire and reswaged, (No. 19 in Fig. 250), the end having been trimmed so that there is not too much surplus. The clasp is teased off the die, and boiled in nitric acid to remove any fusible metal. The pure gold is fluxed and a small piece of solder is attached and soldered in the open flame. (No. 20 in Fig. 251). Too much solder must not be used, as we do not want to stiffen the piece of pure gold which fits into the lug seat. It is placed back upon the model and a piece of clasp metal is used to strengthen it. This can be soldered to the pure gold in the open flame, and reswaged and trimmed with a stone. After boiling in acid, it is ready for assembling.

CHAPTER XVI

Round Wire Clasps

Lugs and Lug Seats.

I do not believe that the value of lugs is properly realized. Most men use them solely to support the weight of the denture. This may be correct in certain types of cases, but in a Class I case, or a Class II, or a Class III case, where we have a long span ending in a lateral incisor, it is an error to believe that lugs will support the denture. Nevertheless, the lugs in these cases are very useful. They will not entirely support the denture, but they serve as contact points, preventing food from jamming down between the teeth and the clasps, thus avoiding recession of the gum at these places. Hence in these types of cases, the lug need not be more than a slight turnover; just enough to prevent food from jamming between the tooth and the clasp, and this can very often be made a part of the clasp, especially if it is a flat plate, or a round wire clasp. On the flat plate clasp a little lip is left (Fig. 251) which can be strengthened with solder, and with the round wire clasp, a little loop can be constructed and strengthened with solder. (Figs. 252 and 253.)

In Class III cases and its modifications, in Class IV cases and in modifications of Classes I and II, the lugs actually bear a great part of the stress of mastication and must be made sufficiently heavy so that they will not break readily. If the tooth to be clasped is out of occlusal contact, tipping slightly, it is not necessary to grind a step in the margin of the occlusal surface, but a great many cases do require grinding; and let me say here, with emphasis, that if you decide to grind a step for a resting lug, do it before your final impression is taken, because if the patient objects to this procedure, the case will be ruined. Decide this when you have your study models made. Also, from a technical standpoint, the lug seat should show upon the working cast to afford opportunity for an absolutely accurate adaptation.

It is a strange fact that men who think nothing of grinding large cavities for inlays, or of grinding off entire surfaces of teeth for crowning, raise serious objections to the little grinding we sometimes do on the marginal ridges at the occlusal contact points of the teeth.

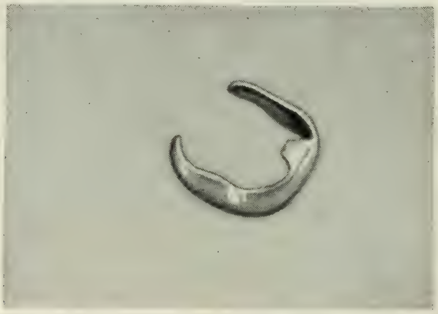


Fig. 251—Lug bent from body of flat plate clasp to be strengthened with solder.

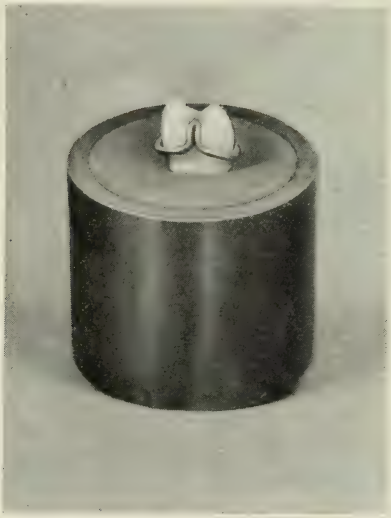


Fig. 252.—Lug bent from body of wire clasp to be strengthened with solder.

Also, few men realize that a certain amount could be taken off of the opposing tooth where it strikes the lug. As this is generally the point of a cusp, no damage is done. This is particularly true where we use a Jackson crib clasp, where it runs across the occlusal contacts of the teeth. Here, if we use a 19 gauge wire, a small round stone may be used to increase the distance between contacting teeth, just enough to make room for the resting wire. We need not grind off enough to accommodate the entire thickness of the wire, as something can be ground from the cusp of the opposing tooth. The mutilation is very slight. I have sometimes done it with a Burlew rubber disk or a sandpaper disk, the patient raising no objection, as he evidently thought I was polishing the tooth.

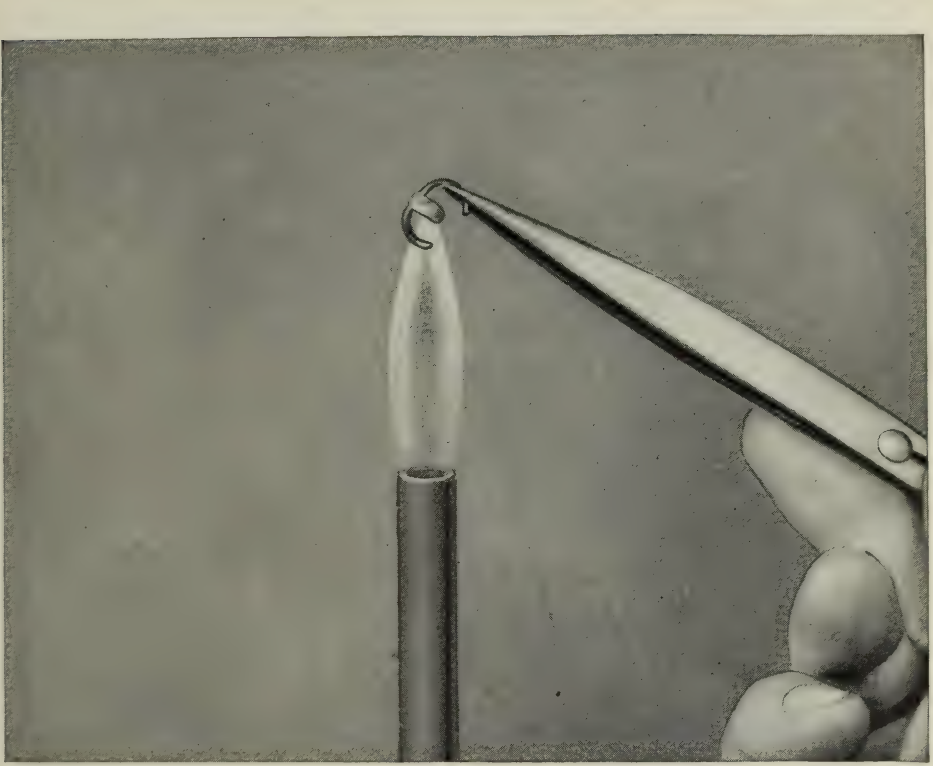


Fig. 253—Wire clasp with pure gold for burnishing in lug seat soldered with small piece of solder in open flame.

Lug Seats in Fillings.

In many instances, the step, or seat, can be ground in a filling which had not been properly contoured, and the contour may even be improved. The grinding should always be done by means of a round stone, so as not to leave V-shaped grooves, because if a V-shaped groove is left, we are liable to cause a separation of the teeth, which never occurs where the grinding is done with a round stone, or where no grinding is done.

The lug seat which I prefer corresponds to a No. 18 round bur; that is if the tooth is supported mesially (or distally) and will not drift. With the ordinary round wire clasps, if the wire is fine enough, (18 or 19 gauge) the wire can be bent to fit into this lug seat and soldered together at this point and at this point only, as shown in Fig. 252. If we wish to make a stronger lug, we can place a small piece of pure gold plate, 36 gauge, against the clasp at a point which will correspond with the lug seat, and solder it in an open flame. This soldering should be done with the most minute piece of solder (Fig. 253); consequently we do not stiffen the clasp, or the piece of gold which is to fit into the lug seat. The clasp with this piece of gold attached is placed upon the cast, the pure gold is burnished to fit the lug seat, and then trimmed so that there is a slight surplus around the lug seat; about 1 mm. (Fig. 254). This surplus allows us to engage it in the investment when we do our final soldering. Fig. 255, A, B and C, shows the technique for a flat plate clasp but is used also for round wire clasps.

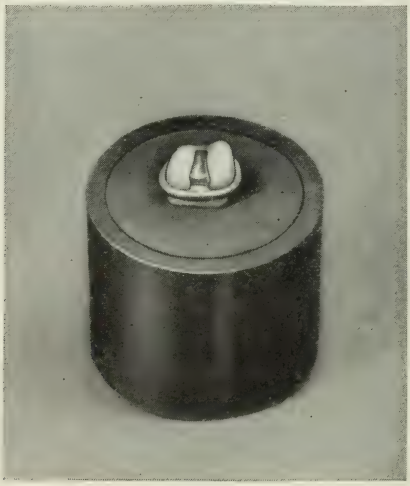


Fig. 254—Clasp placed on tooth and pure gold burnished into lug seat.

I prefer to do all my burnishing upon the cast if I know it to be accurate, but if for any reason the cast is inaccurate at this point, I have the clasp made up to this stage before the patient comes in for the bite. I then place these clasps in the mouth and do my burnishing directly on the natural teeth. Then I stiffen them by taking a stick of sticky wax, and heating the end of it, pushing down against the gold in the lug seat, and engaging the clasp. (Fig. 256.) The wax will harden and the relation will be maintained.

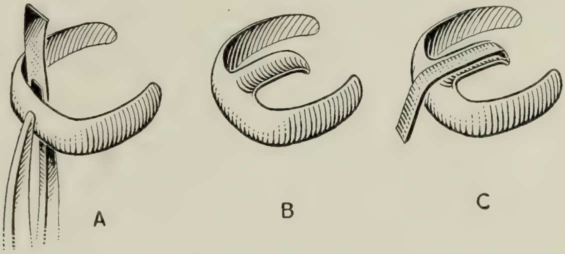


Fig. 255—Diagram of steps in technique. This shows a flat plate clasp, but the technique is used also for a round wire clasp.

The clasps are taken to the laboratory, immediately invested in wet asbestos, the wax burned out and the gold in the lug seat is filled with solder. Solder alone is not strong enough, as it is brittle. For this reason, a piece of half round wire is bent to fit the depression, the round portion going down, (Fig. 255 C) and solder is flowed over the parts. This requires the minimum quantity of solder. The clasps are dressed down to shape and tried again in the mouth to see that they have not been distorted. Then they are placed back upon the cast. If a lug seat on the cast is not deep enough, the No. 18 round bur is used to cut it deeper. In this way, a very accurate fitting can be obtained.

In cases where we expect settling to take place rapidly, due to the fact that the ridges are soft and have not been compressed by dentures, it is advisable to burnish a piece of thick tinfoil into the lug seat, so that when the clasp is assembled, it rests upon this tinfoil. This allows a slight settling, within the first few days, and does not bring excessive strain upon the lugs. Judgment must be used, however, in following this method and it is only employed where we are hoping to get saddle support in combination with lug support. In these cases I use heavier round wire, with a high karat solder, which will permit a certain amount of bending, and if the case settles very much, the lugs can be bent slightly one way or the other to compensate for the settling; but only very slightly. If a low karat solder is used and a large quantity of it, the solder may crack and the lugs break off.

The half round wire which connects the lug to the clasp is seldom used as an attachment for the clasp to the denture, because we will find, in a properly designed clasp, that the resting lug is not in a line with the strut which attaches the clasp to the denture. This is particularly true of flat plate clasps. The lug generally is in the middle of the clasp. The connecting strut is nearer to the lingual side of the tooth, so that it shall be kept out of the way of the teeth which we wish to fit into the space. With the Gillett clasp, or the double wire loop clasp, or even the single wire clasp, this is not so important, as the supporting strut can be placed under the wire and does not take up any more room than the clasp itself. With the continuous clasp and the flat plate clasp, however, we place the supporting struts towards the lingual side, which should correspond with the mesial, or distal angle of the tooth.

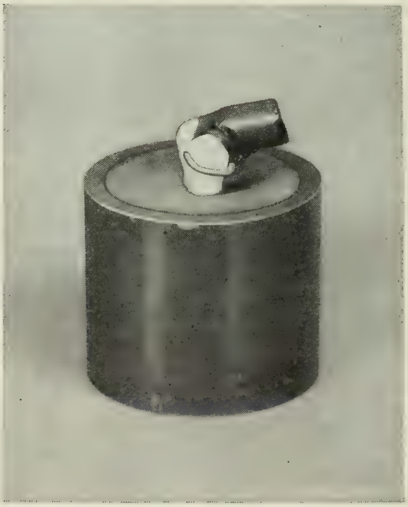


Fig. 256—Sticky wax pushed against pure gold in lug seat ready for investment. Same technique is available when burnishing is done in the mouth.

Shape of Lug Seat.

The shape of the lug seat is highly important. Where there are fillings in teeth, or where we are grinding into natural teeth, the small, round lug seat answers all purposes and I believe is far superior to other types, provided the tooth is supported, either mesially or distally, to prevent drifting. To be more explicit, let us suppose that we have a bicuspid with a space between it and the tooth in front; the round lug seat would simply act as an inclined plane and if the ends of the clasps were not long enough to hold the tooth from drifting, it would act as a regulating appliance. The bicuspid would move forward and the lug would drop out of the seat. But if the clasped tooth is held in tight contact with the cuspid or bicuspid ahead of it, there is no possibility of this taking place. The round lug seat offers the following advantage. It allows the denture to move slightly, as in a ball and socket joint, and acts as a stress breaker, no undue strain being placed upon the tooth as occurs with flat lugs, or with the slotted attachments.

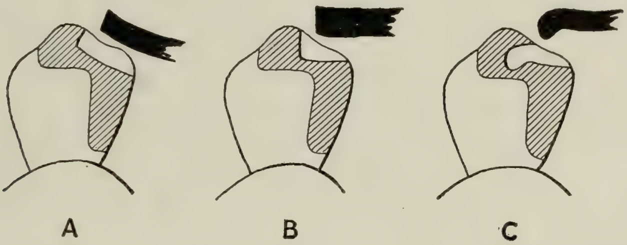


Fig. 257—Diagram of lugs and shapes of lug seats. A—never should be used. B—Can be used, but never unless tooth is supported anteriorly. C.—To be used when tooth has no anterior support.

In the molar regions, where the tooth is tipping forward, there is seldom any danger that it will drift backwards with a round lug, and it will never occur if the ends of the clasps are sufficiently long to engage the distal portion of the tooth. Fig. 257 shows three forms of lugs; the wrong one Fig. 257 A should never be used; Fig. 257 B can be used where the teeth are supported anteriorly. Fig. 257 C shows one which is to be used where there is no anterior support. This last type requires the making of an inlay and I will describe it in the next few paragraphs, but before doing so, I want to say something about square seats for lugs.

Square Lug Seats Condemned.

I believe square seats are a snare and a delusion in the average case, and the only place I ever use them is where I am making what is known as a half clasp on a bicuspid tooth. That is, where the clasp extends around the lingual side of the tooth and does not extend to the buccal. I only use this clasp on well selected cases, where patients object to a show of gold, in which cases the lug seat is made square, and the lug which extends into it is nicely fitted so that this lug takes the place of the buccal wing of the clasp. I have found, however, that in properly preparing an inlay for this type of clasp, we are generally compelled to show more gold than if we used a mesiodistal clasp, and with greater destruction of the tooth surfaces, and I can safely say that I do not use more than two a year and then only where there have been inlays in the teeth before. Another disadvantage of this type of clasp is that more strain is placed upon the abutment teeth when we get the side-to-side motion of the bite in mastication, than when we use the slotted attachment and I would much prefer to use the slotted attachment of the Chayes or the McCullom type, or the Roach flat button attachment.

Lug Seats in Inlays.

If there are fillings in the teeth which must be replaced, it is a very simple matter tc make provision for a lug seat. The wax in the inlay is cut out with a No. 18 round bur and the inlay is pressed or cemented into position before we take the impression. If, however, the tooth is unsupported anteriorly, we must bend the wire of the lug to form a hook as in Fig. 257 C and in this instance have a cavity prepared for the inlay, taking the impression of the inlay by the indirect method, making a die and preparing a wax pattern in it. The impression for the denture is taken with the cavity open and with no temporary filling in it. When the impression is assembled the amalgam die is placed in its proper position in the impression and the cast is poured. This allows us to go on to construct the framework for the denture, then completing the lug with its hook which is forced into the wax of the inlay. The patient is asked to return, the temporary filling is taken from the cavity and the frame tried in the mouth to see that it is correct in all respects. Then we lift out the inlay wax and place it in the cavity. If the lug does not fit exactly, the wax can be softened and the frame pushed to place. The edges of the wax are trimmed in the mouth and finished. The frame is carefully lifted from its position, the wax pattern taken from the cavity and immediately invested and cast. When this is finished, it can be placed back in the amalgam die and the frame should fit it exactly. The hook shaped lug should fit in the inlay. The same procedure is followed where we are using a square lug except that the square lug is made of square wire, one of the platinum and gold alloys, soldered to the clasp, and should be highly polished before it is pushed into the wax pattern of the inlay. When the piece of work is finished and occluded, the inlay is cemented, and the lug should fit into it perfectly if you have checked up at each step.

CHAPTER XVII

The Bonwill Clasp Technique

Reading over literature in the older copies of dental magazines, I have been impressed many times with the technics presented by our pioneer dentists. In many instances contrivances described as new and novel by our modern writers, are simply repetitions of what has been published long before. Evidently the writers of today have not looked through the files of the old magazines, and are convinced that they have done something original.

There is one man, outstanding in the prosthetic world, who formulated important basic principles for articulation, platework and clasps, and that is Dr. Bonwill.

In 1889, Dr. Bonwill gave us the fundamental principles of a clasp, and so far as I can see there has been no basic improvement to the present date. He recognized the principles of the movable type of clasp and he enunciated the principles of occlusal rest lugs. His writings, if read for the first time today, would be thought modern. Dr. Bonwill had difficulty in presenting these advanced ideas to the dental profession until Dr. Ottolengui, recognizing the value of this work induced him to rewrite his paper and then published it in 1899. I shall present passages from it in this chapter, because I consider it the most important contribution to prosthodontic devices during the last fifty years.

Dr. Bonwill used the flat plate clasp. I believe that if he were living now, and had the modern clasp gold wires at his disposal, he would advocate wire clasps.

He saw the disadvantages of too close contact of clasps with the enamel. I often wonder what his comments would have been if the modern cast clasp had come into vogue in his day. In his articles he describes the use of amalgam for building up teeth. Of course, with the advent of the modern cast gold inlay, we have a filling more adapted to our needs. I am sure Dr. Bonwill would have been among the first to adopt this.

His work has been much misconstrued and misrepresented. I believe that one of the men who is best applying Dr. Bonwill's principles in modern dentistry is Dr. Henry W. Gillett, of New York City. These methods have been tried out since 1889. Two members of my family were treated by Dr. Bonwill and wore dentures made by him for over twenty-five years. I know a dentist in New York City who has worn a Bonwill bridge continuously since 1903 and is still using it, and the abutment teeth have not been injured. This same man is one of our best Peeso bridgeworkers, and later, when the slotted attachments were introduced, he constructed some beautiful pieces of that type, and yet in his own mouth he prefers the Bonwill principle.

The following very liberal quotations from an article by Dr. Bonwill (*"New Methods of Clasping Artificial Dentures to Human Teeth Without Injury, versus Immovable Bridges," Items of Interest,* September, 1899, P. 656-670) are introduced because of their importance and value in a textbook which is especially intended for the undergraduate, who probably might never otherwise become cognizant of these technics, originated almost thirty years ago. In order to make as little alteration of Dr. Bonwill's text as possible, his original illustrations (which were based upon pen drawings made by the author) will be reproduced, the same numbering of the figures being utilized.

The Bonwill Method of Partial Denture Retention

"It requires no skill to whittle a natural crown to a point and slip over it a loose gold crown cap and cement it to fill up a bad fit. But it is another matter when you have to take the place of a mechanical engineer and plan and work to the finest lines without any cement to help you."

* * * * * *

"No one should attempt this method who is not possessed of the talent of an engineer and has pluck and persistence to overcome every obstacle that he will find in each and every case."

* * * * * *

"It is not much of a problem to clasp teeth that have parallel walls. This has been done. But even here the place where the clasp is soldered to the plate should be treated by this method, to give spring to the full length of the clasp. Some think the mystery is solved when they declare 'It is this lug that does the work.' This lug is only one factor, but in connection, bears a noble part. But it is all valueless without knowing just where to solder the clasp to the plate."

* * * * * *

Danger of Decay Reduced To a Minimum.

"I will say here that when the plate is fitted, as soon as clasps are soldered, if it is seen that one clasp, or both, have gotten out of place, or had not been adjusted in the plaster impression of the plate and plaster for soldering, cut it off at once and make no attempt to bend it to fit. It will never feel comfortable. Do it over again. This has always been a great source of uneasiness and cause of disease and loss of teeth from decay and undue pressure. You will demand: 'What per cent of your clasped teeth decay?' This is so seldom the result of this method that I do not take it into account. Teeth of poor structure and with fillings in them and exposed at the cervix from great recession of gum after extraction and absorption of the processes, will invite decay and must be watched.

"If the clasp goes too far down on the cervix there must be vigilance. But with every disadvantage to its application, and consequent risk of caries, I hesitate in no case, knowing what I do of the amalgam I use in filling, and how, with bibulous paper, I can fill a shallow groove completely around the periphery of any part of a tooth clasped.

"The ever silent current made by the clasp on amalgam may darken very slightly the latter, but no decay have I ever found along the margins of these amalgam fillings.

Origin of the Method.

"Time, with experience, levels all things. How one's practice will be changed if truth be uppermost!

"I am surprised at the many somersaults I have made in nearly forty years.

"In one thing I never have changed from the beginning of my career, and that is, never to sacrifice a tooth without a struggle for its existence. A human tooth has always been treasured, as a physician would the living body, and with the experience gained and ingenuity in overcoming difficulties, I seldom, today, extract a tooth."

* * * * * *

Errors in Old Methods Which Lead to New.

"During all this time I had seen many cases of clasping good teeth, and the reason of decay and wear where the band was placed was apparent.

"*First.* Any one who has any idea of pure mechanics in dentistry must admit that artificial dentures are placed in without any method, reflection or planning—certainly not as a mechanical or civil engineer would do in advance on paper—and with no system to reach the greatest strength of plate and artistic appearance. It is astounding how persons ever get used to sets of teeth where no articulation has been given. True articulation is a sealed book to the majority.

[By "articulation" Dr. Bonwill evidently meant "occlusion."—EDITOR.]

"*Second.* Bands are allowed to go far up and under the gum border. They are never wide enough. They have either too much spring or not enough for each individual case.

"*Third.* The clasp is allowed to move constantly up and down on the tooth until the tooth is worn very materially.

"*Fourth.* The clasp is soldered to the plate always in one spot—on the anterior or distal surfaces of the tooth, *just where most spring of clasp is needed.*

"*Fifth.* The clasp has always been soldered on to the plate by fitting both to the plaster cast and soldering them immediately from that.

"*Sixth.* This plan of soldering never allows the plate to fit as it should, since the clasp draws the plate away from the tooth, and the tooth is forced out of its place and is never easy. (Comfortable?)

"*Seventh.* The value of the clasp is lost through not comprehending the exact relation it should bear to the plate.

"*Eighth.* While the clasp and plate may fit well, it is always a failure if the proper articulation is not in keeping with the opposing teeth. It causes all the strain to come upon the clasped teeth, when the plate should rest easily on the gum, and the clasp be firm yet not binding on the tooth.

"*Ninth. The clasp made to fit too closely to every part of the surface of the tooth enveloped results in decay, from the fine capillary surfaces made by the too near contact of clasp and tooth.*

"*Tenth.* From the imperfect soldering of plate and clasps the bands have to be made to closely hug the surface; and, from the narrow necks of most teeth capable of being clasped, the plate is pushed too hard up against the gums, and to make the plate remain in the mouth the clasps are required to be stiffer and are never quite comfortable. There is not only wear, but caries is produced from the driving of the gum away from the cervix.

Failures of Bridges.

"To add to this experience of clasping, there have been many failures from permanent and removable bridges. To grind off the entire enamel from any sound or partially sound tooth or teeth, to place over it a gold cap for one or many teeth, is the most unjustifiable of vandalisms. The cement placed between the caps of gold and the tooth never fills the space, being pushed out or away. Especially is this true of those cases where a part of the face of the natural tooth is shown from the cutting away of the gold cap.

"The cement is put in so thin that it is sure to wash, or be dissolved by the powerful capillary force exerted by the oral fluids.

"To add to this misery, the cervical border is seldom free from constant irritation. It is only necessary to allude to the stench arising from the accumulations upon the surface of the gold, like barnacles on a ship's bottom.

"A bridge cannot be kept any cleaner than a plate that is removable, and I never saw one of the latter that did not have to be polished out of the mouth with the same care as table silverware.

"The dentist who will learn to place in partial and full upper or lower sets as they should and can be, and give no trouble to the wearer, will never resort to bridging except in very favorable cases, and not then by ever mutilating a good natural tooth for a gold cap.

The Bonwill Method of Clasping.

"It is not necessary to fill the whole arch and palate with a plate, where a few teeth remain. A narrow, heavy plate, unyielding in character, will stay up just as well when confined alone to the alveolar border. Or where one, two or three teeth in either jaw must be replaced, they will need but one full clasp and a very small plate to act as a saddle.

"When the idea is once grasped of how a clasp should be fitted to a tooth without mutilating it, and how the clasp should be soldered to the plate, then dentists will see a new era dawning upon them.

"First, how should a clasp be fitted to the natural crown of a tooth to prevent future caries, and also prevent wear, and of what material and how heavy or light the metal, and how wide and at how many points upon the crown's surface should it touch to insure its steadfastness or security?

Construction of Clasp.

"The thickness of metal is dependent upon the length of clasp, the width of same, and whether one or more clasps will be used to sustain the plate, or where there has to be very much spring to the clasp in passing over a crown that is very much out of perpendicular.

"The metal should be of platinized gold only, without any lining of pure or twenty-two karat gold soldered on it next to the crown. The metal should be loosely fitted to the crown on the plaster cast and afterwards fitted in the mouth directly upon the tooth and made to touch in at least four places. It should not be struck up to fit accurately every inequality of the surface, nor should pure gold first be fitted to the tooth by burnishing it on and then soldering that to the platinized gold. (1).*

"If a clasp fits minutely all the surface of the crown, it makes of the minute space between the crown and clasp a capillary surface, and keeps the mucous secretions, as well as the fine food, forever in contact, and with no space for circulation of the saliva. Whereas, if the band touches but a few places on the tooth-crown, it will rest just as firmly if it has been well fitted in the mouth and allowed to take its own position when tried upon the crown.

"Capillary power made by surfaces very closely approximated is the surest means of producing caries. Where a space is left, the points that do touch are in absolute contact, and, aside from a slight wear on the tooth, the surface cannot decay as when there is an actual and close fitting. If made of fine soft gold, there would always be danger.

"A clasp is not needed to grasp the crown very closely. The width of clasp should be as great as can be made, and to steady the plate without grasping it firmly. This will be a new idea to many.

Point of Attachment of Clasp.

"Next to the clasp in importance, is to know where it should be soldered to the plate, and on which side of the crown to allow it to go on and off, where the crown is very much out of perpendicular. (2).

"In this lies the principal part of the plan, and upon it depends entirely, or greatly, the success of the operation. The plate may fit perfectly, and also the clasp, but all is vain unless the point is known where to unite the band and plate.

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* These bracketed numerals will refer to comments by the author which will be found at the end of this chapter.—Editor.

"This cannot be done unless a plaster impression is taken of both the clasp and the plate in the mouth, so that the exact relation is obtained. The impression of plaster is now run with plaster and sand and the case soldered. To make the whole thing a perfect development the little gold angular tip* must be soldered either to the clasp or the plate to keep the clasp from moving up and down. (3).

"It should be made of very heavy platinized gold and fitted to the top of the crown around which the clasp goes and upon that part of it that will be free from the antagonism of the opposite teeth. The side of the crown should be selected and marked by observations made in the mouth at the first visit. These can be fitted on the plaster cast.

"When the impression in plaster has been taken of both clasps and plate, the easier plan will be to pour plaster and sand into it, and it is then exact, all ready for soldering.

The Occlusal Rest Lug.

"Before any teeth are placed on it, by all means, try it in the mouth to see if it will go in and out; for unless the impression has held all the pieces in exact apposition, the plate will not go in or be removed easily. A little filing may be needed to help in the adjusting. Frequently, where the tip rests on the grinding surface of the crown, the latter has to be ground to let it rest firmly, which keeps the plate from anything more than resting in direct contact with the gum. This must be adjusted very accurately, and the plate will act as a saddle on the gum to prevent riding. This rest prevents any changes of position of the clasp of the tooth, and also any chafing on its surfaces. It is an absolute necessity. It is better that it should be soldered to the plate than upon the clasp, as there will be more steadiness; but it must not interfere with the spring of the clasp. The drawings will show the best place for them on the tooth-crown. They should be very strong, as the force of mastication falls upon them. Use eighteen carat solder for every attachment. These tips can rest on either a gold or amalgam filling, or the body of the tooth. If the latter, the enamel may be cut to prevent the antagonizing tooth from touching the tip. (4).

"Where there is decay upon the tooth to be clasped, I prefer to use amalgam containing much gold in it. There need be no fear of galvanic shock so long as the clasp is in direct contact with the amalgam.

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* By "tip" Bonwill meant what is now called a "lug." Later he also calls it a lug.

"As I have already stated, the injury done to the tooth, where a clasp is upon it, is from the food being allowed to remain for weeks in contact—never from the clasp where it touches, unless too accurately fitted.

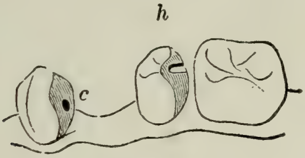

Fig. 1

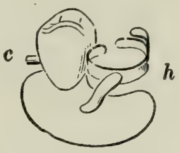

Fig. 2

"Each case must be thoroughly studied after the plaster cast is made, or the result will not be satisfactory. The points on the clasp and plate where the bar (strut) is soldered to connect them *are the vital parts,* and, unless judiciously chosen and the bar made of platinized gold wire, and the base plate of two pieces of gold soldered together to stiffen it, and the clasp of proper width and thickness, the strain placed upon the mechanism will break it. The bar holding the clasp and plate must always be upon the side of the tooth where there will be least resistance. Take a second inferior molar that has tipped forward very much and also inclines to the tongue. Here the soldering should be done as far back on the buccal side of the clasp as can be accomplished. Then the spring of the clasp is not needed for the buccal side, but for the anterior and lingual sides, where projecting from a perpendicular. If soldered from the lingual side, it would be impossible to get the clasp on or off. (2).

"In the upper cases it is generally the reverse, although there are many exceptions, and no rigid rules can be laid down. Each one must be specially studied, or no good results. Nor can you rely upon fitting plate and clasp to the plaster cast and soldering from that. Take the trouble to take impression of both plate and clasp in the mouth, and then solder from that. (3).

"A study of the cuts will give an idea of this work, but it will not appear so clear until it is attempted. The articulation for one or two teeth I do directly in the mouth, but for three or more I prefer my articulator, and put on the minute details after the teeth have been attached.

Cases Illustrating the Method.

"The letters on each cut have reference to the same parts on all. Fig. 1 is a case for first upper bicuspid, right side. A filling of gold was placed in the distal surface of the natural cuspid with a hole, *c*, drilled into it for the pin in Fig. 2.* The second bicuspid had also a large amalgam filling, around which the clasp was placed, so that it would not show from the mouth. Fig. 2 shows the plate with English crown thereon, with pin soldered to the plate. The clasp has a tip at "*h*" soldered to it, and "*i*" is the heavy platinized gold bar, showing how it forms the attachment between plate and clasp, and just where; "*c*" is a pin, soldered directly to the plate, which enters the hole in the gold filling shown in Fig. 1.*

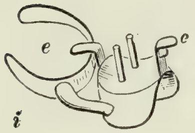

Fig. 3

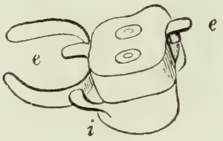

Fig. 4

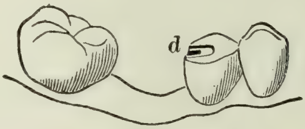

Fig. 5

"Where no filling is in the cuspid I should use a short clasp fitted near the cervix, to reach from the palatal surface to the buccal, where it would not show from the outside, and soldered on the extreme palatal side to gain a spring.

"Fig. 3 is the skeleton of a plate without the crown, which shows clearly the case for which it was made. (See Fig. 5.) In Fig. 3 is "*e*", the tip, resting on the second molar, soldered to the plate. On the plate next to the second bicuspid is soldered an upright with a tip "*e*", and a thin, narrow projection underneath it, which sets in a groove where shown at "*d*", in Fig. 5, in an amalgam filling**to keep the anterior of plate in position and to prevent the plate from pressing too hard—upon the gum; "*i*" is the bar connecting plate and clasp on the lingual side. One or more pins for the crown can be used.

"Fig. 4 shows the same with the crown cemented on with oxyphosphate, or with gutta-percha, or vulcanized.

"Fig. 5 is a case, left side, lower jaw.

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* This method has been "originated" (?) by many others since Bonwill.

** The modern technician, of course, uses **a** cast gold inlay.

"Fig. 6 is a second bicuspid tooth, right side, lower jaw. The bar *"i"* is soldered to the plate and clasp on the buccal side and the tip on the clasp on the first molar, and, as the crown is made entirely of gold, the tip is soldered directly to it to rest on the first bicuspid, and the anterior surface of the gold crown is made concave to fit into the distal surface of the first bicuspid, which prevents any movement laterally. A gold crown (pointed) is used, as it is not seen, and facilitates greatly the soldering and adds immensely to the strength, and there is no danger when repairing in the future. The back tip, which rests on the molar, should have been soldered to the crown also, and less strain would come on the clasp.

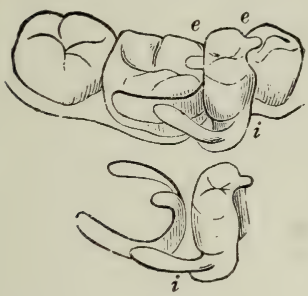


Fig. 6

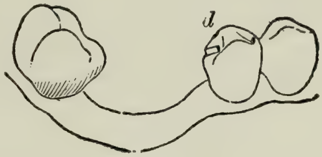


Fig. 7

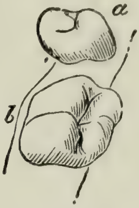


Fig. 8

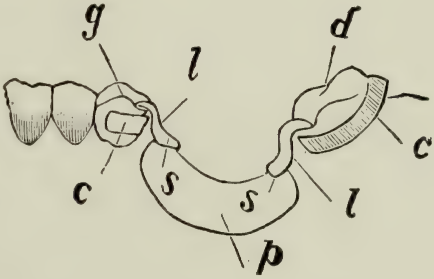


Fig. 9

"Fig. 7 is an extreme case of tipping of the third molar, lower jaw, right side. The clasp was soldered to the plate on the buccal surface, and the plate at the second bicuspid was held as in Fig. 4. It could have been done by a narrow clasp to reach only partially around the second bicuspid, where it would not show on buccal side.

"Fig. 8 is another extreme case where the second molar in the lower jaw projects towards the tongue and the second bicuspid towards the cheek. In this case the bar should be soldered on the buccal side of the molar near its distal proximal surface at *“b”*, and the second bicuspid on the lingual surface at *“a.”*

“Fig. 9 is a structure for the first and second lower molars attached to a very slanting wisdom tooth and the second bicuspid, which has also a slant.

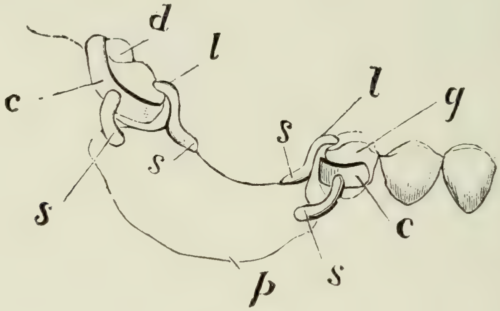


Fig. 10

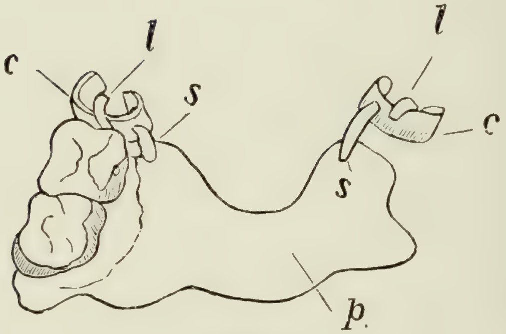


Fig. 14

From the extreme angle of the third molar it would seem to be impossible to fix a clasp to it securely. But this has been done. Fig. 9 is the inside or lingual view showing clasps, *“c c”*, lugs *“l l”*, and where soldered, *“s s”* to *“p”* the gold plate. Fig. 10, shows outside or buccal surface giving the exact place where the bar of platinized gold is soldered to the plate at *“c”* and *“s”* on both the bicuspid and third molar.

“This far away point of the bar that connects plate and clasp gives the clasp all the free spring possible, and when in place hugs the molar firmly and is never detached by use. The lugs *“l l”* are soldered separately to the plate, and the crown surface of both bicuspid and molar should be cut to allow it to fit clear of the antagonizing tooth above. The lower molar at this pitch never needs any cutting. The lugs should stand free of the clasp and, where bent at an angle, always be sure there is no crack from the bending. If so, solder it. Always make them, as you do the clasps, of platinized gold.

"Fig. 14 is a very extreme case where the second bicuspids are clasped on both right and left sides. The divergence is marked, yet with the bars soldered at *"s s"* with the lugs *"l l"* fastened very near the bar that supports the clasp on the plate, success was attained. This is an exceptional case. Usually, the lug should be distinct from the clasp. (4). The gold plate *"p"* is very heavy and extends well back on the plate. In this case, as in quite all clasped plates, the clasps are not placed on both natural teeth at the same time when trying in the mouth. In this case, the one on the right side first, then the other is pressed outwards over the crown when it goes on easily. In removing the plate from the teeth, the clasp on the left, or the one placed up last, must be started first and the other easily follows. But both will not come off at the same time."

Comments on Dr. Bonwill's Paper by the Author

(1). Here we find the first of Bonwill's definite principles, viz. that a clasp should touch a natural tooth at four points, but should not be in close contact with tooth surfaces throughout. Prior to this, it had been the endeavor of practically all clasp makers to produce actual contact as nearly as possible. When we read of his objection to a clasp made by burnishing pure gold to the tooth and soldering a clasp-metal clasp on the outer surface thereof, we can imagine what he would say of the cast clasp now in such common use. Yet it is also true that the dangers inherent in the close contact of a cast clasp, would be much minimized if cast clasps were used only in such places and under such conditions as were described by their originator, Dr. Nesbett, who particularly stressed the point that the cast clasp should only be utilized in the mouths of individuals scrupulously clean in their habits, and only for small bridges of one, two or three teeth. I am opposed to the cast clasp in any form on a natural tooth, except under the conditions which Nesbett has outlined. I believe, however, if it is decided to make a tight fitting clasp, such as the cast clasp, the matrix clasp which will be described later, serves with the least danger of injury to the tooth. Of course, we know that the greater the contact, the greater the food retention, but I have found that the use of pure gold as a lining for the clasp, due to some action of the gold itself, prevents erosion of the teeth. While I do not believe that it is the best clasp, if we cannot convince the men who believe in full contact that they are wrong, then I think they should use the type that is the least injurious. More will be said on this subject in the chapters on the Gillett Clasp, the Jackson Crib Clasp and the Matrix Clasp.

(2). Prior to this pronouncement by Bonwill it was common practice to solder all clasps to the plate along the lingual cervical border of the tooth clasped, and this soldered union usually extended the full width of the lingual side of the natural tooth. This created a stiff, resistant area in this region, and in connection with bell-shaped, or badly tipped teeth, it was often impossible to force the plate into position. As a result the "bulge" of the tooth was often ground away, thus mutilating the tooth. Bonwill introduced the idea of attaching the clasp by means of a bar, or strut, rather than to the plate direct. Often, as will be seen in his illustrations, this strut might be placed at one extremity of the clasp, or even on the buccal side of the natural tooth, thus allowing full advantage of the elasticity of the clasp, which would spring open to permit passage over the bulge of the tooth.

(3). It will be observed that Bonwill advises that the clasp should be adjusted to the natural tooth before it is soldered to the plate. By this means the clasp can frequently be seated about the tooth so that it will firmly grasp it, whereas it would never be so efficiently placed if the soldering were done on the original cast, as is so frequently recommended now, some even going to the extreme of casting plates or saddles, and clasps all at one time. There is no doubt that this can be accomplished and that it may even appear that a perfect grip has been obtained, yet it often is the case that the clasps appear to be efficient, because two or more clasps hold the plate in position, whereas if one were cut from the plate it might easily be seen that the remaining clasp is contributing little or nothing in itself to the retention of the denture. If each clasp is adjusted in its most efficient position on the natural tooth, and attached separately to the plate, the highest retentive efficiency will be obtained. This of course demands the technique described by Bonwill, that is the adjustment of the clasp about the tooth, the placing of the denture, and the taking of an impression with clasp and denture in their best relation, a cast being then poured, upon which the soldering is done.

Bonwill endeavored to have the clasp as flexible as possible so that the saddle would be brought to its maximum bearing upon the gum when it was bitten upon. The same result can be obtained by rebasing the impression and then the assembling can be made on the same cast. This is what causes the failure of cast clasps in partial platework exclusive of the Nesbett bridges. Dr. Nesbett uses no saddle in connection with the cast clasp as his work is a true bridge.

The modern one-piece castings that are being advocated today are based upon wrong principles. I have seen some of the modern advocates of one-piece casting try to fit a denture and when they had reached what they thought was the limit of the grinding of the clasps, they ruthlessly cut the enamel surface of the tooth to allow the denture to go into place. I consider this as little less than malpractice; and when we know that these one-piece castings must be made with low karat gold to insure a semblance of a fit, we must realize that in the use of a one-piece casting the commercial spirit outweighs ethical ideas.

(4). In regard to occlusal rest lugs (tips he calls them) it should be noted that Bonwill preferred that the lug should be a part of a separate upright soldered to the plate, rather than a part of the clasp itself. This contention becomes more valid when, because of the shape of the clasped tooth, or because of the tipping of the same, the clasp must open and close when placing the denture in the mouth. Attention is called to this feature here, because it has become the almost universal practice to place the rest lug on the clasp, whereas in many instances it would serve better if separate therefrom. Indeed in cases where one might be tempted to use four clasps, two would often serve better, if uprights carrying rest lugs were used upon the other teeth. As an example, we might cite a lower bar denture carrying one bicuspid and one molar on each side. If clasps are adjusted to the bicuspids, it is often preferable to use uprights with occlusal rests on the the second molars, and no clasps.

CHAPTER XVIII

The Technics of Gillett Clasps

We have gone into the principles of bending round wire and now we must consider the round wire clasp from a practical standpoint. As I stated in the last chapter, I believe that Dr. Bonwill would have used a round wire if the proper kind of wire had been available in his day. Dr. Henry W. Gillett has developed the round wire clasp to its highest degree of practicability. He has consulted with the Bureau of Standards in Washington and has published a number of important articles on this subject. He and *The Journal of Dental Research* have been kind enough to allow me to quote in this chapter, from his articles in the *Journal* and also to use his illustrations.

Dr. Gillett calls his clasp the "modified crib" but I believe this is a distinct addition to the art of dentistry and should be called the Gillett Clasp. He has studied the subject with the Bureau of Standards and has designed his clasp to utilize both torsional and the flexure elasticity. Dr. Gillett thinks that the outline for his clasp should go lower than that which is made by the clasp surveyor. When he speaks of placing the clasp at the gum line on the buccal side of the tooth, he means when the gum is in its normal position and has not receded. As a matter of fact, this is about the only place where it can be placed on a lower tooth, and on a great many of the upper teeth, especially if they are in normal position. Otherwise, the clasp would be above the height of contour. He never allows the wire to impinge on the cementum if the gum has receded and he heartily agrees with Bonwill in the principles he has laid down.

Wire Suitable for Clasps.

Dr. Gillett has found that he can utilize a smaller gauge wire than is commonly used, even sometimes two and three gauges. In other words it is common to use 16 and 17 gauge wire, but he has found that by properly designing the clasp and using a wire amenable to heat treatment, it is possible to use 18 and 19 and 20 gauges. He uses the wire recommended by the Bureau of Standards, developed by Mr. Coleman and the Weinstein Laboratories. Ney & Co. are manufacturing these wires, but I believe the formulas are available to other manufacturers. The elasticity, the tensile strength and the number of bends that can be made in this wire without fracture are greatly increased. The writer has been using this type of wire for some time and finds it excellent, but it requires very careful handling, until it has been heat treated. The wire should be carefully annealed and immediately plunged into cold water, which softens it. If we are bending the wire at right angles to itself, or a lesser angle than this, it should be annealed several times during the bending process.

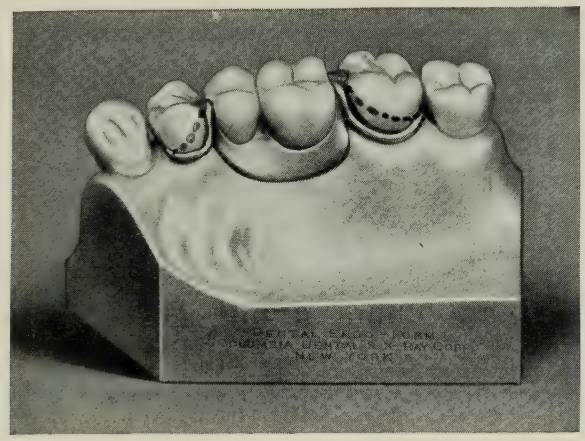


Fig. 258A. Palatal view of bridge with two lugs, molar clasp with two arms of two segments each soldered to molar lug and bicuspid clasp with one arm of two segments soldered to bicuspid lug, the latter clasp operative on palatal side of the tooth and opposed by the rectangular stabilizing lug, which makes effective the clasp grip, and by reason of the relation of its flat sides and seat, resists tendency of the light clasp grip to shift the position of the tooth. The dotted lines on bicuspid and molar teeth show where the clasp surveyor would mark the tooth. Dr. Gillett prefers to bend the clasp lower down because of the great resiliency of the clasp wire. This is correct; no injury results to the tooth as it would with the old wire, or a cast clasp if placed at this point.

If, because of a much contoured tooth, or for any other reason it were desired to use on such a bridge, the modified crib (Gillett) clasp, it may easily be done by extending the saddle alongside of the molar, to provide for the required attachment at its disto-palato-approximal angle, allowing the occlusal segment to lie free in the groove cut in the lug. See Fig. 259.

A second variation would be to solder the clasp at the mesio-palato-approximal angle, letting the edge of the saddle make the necessary tooth contact to oppose the clasp.

Both of these plans serve to lengthen the clasp and consequently increase its factor of safety as related to possible deformation, breakage and durability.

The instruments we bend with should have no sharp corners, or the wire will be nicked and this will later cause the clasp to break. We should also be careful in polishing, not to polish the wire flat on one side. These directions hold true for all round wires. This wire of which I am speaking withstands a great deal more abuse by the patient than other wires. I believe the careless handling of it in construction causes many breaks. Likewise, we should be very careful as to where we solder. Minimum quantities of solder should be used, and the soldering should be done at a point on the clasp as far away from its free end as possible. Dr. Gillett has given great consideration to this, and unilateral pieces of work, which he shows in his illustrations, embody this principle.

The Gillett clasp follows the general outline that the clasp surveyor inscribes, with the possible exception of that portion of the clasp in the buccal or lingual embrasure between the teeth. Fig. 258A shows the difference in the outline of the Gillett clasp and the one made by the clasp surveyor. The dotted line would indicate the extent to which the surveyor would deviate from the Gillett outline.

Bending and Soldering Wire Clasps.

In bending the Gillett clasp it is practically impossible to correctly fit the clasp unless we begin at the mesiolingual side of the tooth, bending for the curvature of the lingual side, then running it up the lingual embrasure to about at a point where the contact would be, then over and across the occlusal embrasure, then down the buccal embrasure and around the buccal surface of the tooth. Each step should be verified before going on with the next, and before making a sharp bend, the wire should be annealed by heating, and plunging it in water. It is practically impossible to get a well fitting clasp if we begin at the center and bend towards each end.

If working on a metal cast, the clasp should always be boiled in 30% nitric acid before heating it, in order surely to avoid injury from fusing base metal onto the gold wire, with resulting development of brittleness.

Another error which is very destructive to clasps is to apply too much solder at the point where it is held. This nearly always causes the metal to crystallize and later to crack at this point. Where the resting lug must be soldered to the clasp, or the clasp to the plate, I have been soldering with Ney's casting metal, No. B-2, and I have been getting better results. I believe that the zinc which is in some of the solders, has a deleterious effect upon the metal, and causes it to crystallize and break. Of course, where we have a swaged gold of 18 or 20 karat, we cannot use the Ney's No. B-2, as it has a higher fusing point than the plate, but if we are constructing a cast denture, or a wrought denture of clasp metal, it can be used readily. Wherever it is possible to attach the clasp directly into vulcanite, I have found that we have less breakage. I have

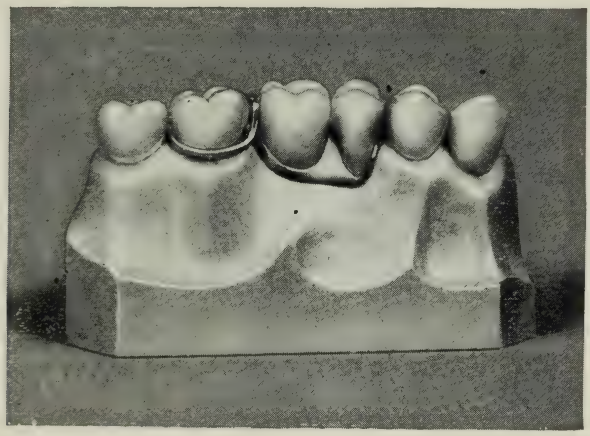
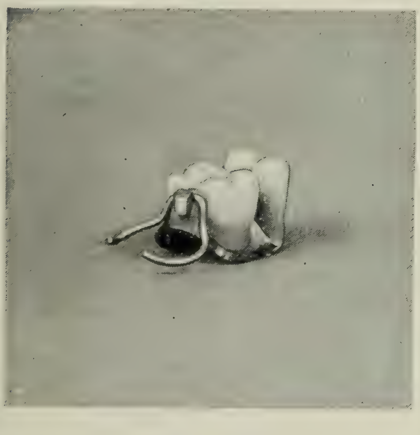


Fig. 258B. Buccal view of bridge shown in Fig. 258A. Note absence of buccal arm of bicuspid clasp.



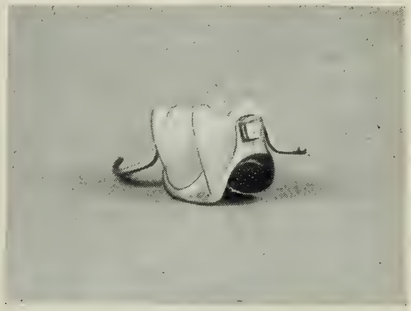


Fig. 258D.

Fig. 258C.

Fig. 258C. Distal end of the bridge in Fig. 258A, showing molar clasp and lug.
Fig. 258D. Anterior end of same bridge showing single clasp arm and nearly rectangular form of stabilizing lug.

often noticed that where a clasp has been broken, and, in making the repair we cut out the rubber and vulcanize the new clasp without soldering, we seldom have much trouble with its breaking again. Also that the breaks nearly always occur at the point of soldering. In order to fully expound Dr. Gillett's ideas and methods, I shall quote extensively from two of his papers. The first, which follows immediately, was published in *The Journal of Dental Research,* June, 1923.

Dr. Gillett's Clasp Technique

"Every one will admit without argument that, with few exceptions, teeth missing from the human dental arch should be replaced with artificial substitutes, to the end that the efficiency of the masticatory apparatus may be preserved and that the drifting, tipping and extrusion of the teeth, and the traumatic occlusion that always follows the loss of even a single tooth, may be minimized. With this assumption, let us pass on to the consideration of the means at our command for rendering that service. It is a matter of constant comment that, as a profession, we are prone to follow the latest new idea; to seize upon each new discovery or alleged discovery; and to grasp each new device, new theory, or new development in technique, turn it into a fad to be ridden beyond the bounds of reason and, frequently, to be discarded in favor of something new, when our patients' best welfare would dictate its continued use.

"We are prone to run after strange gods with much enthusiasm. One of our great surges in that line was the craze for the fixed bridge. How enthusiastic the profession was over its possibilities, and with what fervor many of us repudiated it when our eyes were opened. Whether the fixed bridge will ever regain a generally honored position with the profession is doubtful; but, stripped of its more evil companions—slipshod technique, septic root-canal therapy, and the results of deficient judgment in selecting its field—it is coming to be recognized, by some thoughtful practitioners, as a 'fairly respectable citizen,' within strict limitations. I confess, with some sense of chagrin, that not many years ago I endorsed the statement that there is no place in dentistry for the fixed bridge. At that time I was strongly influenced by the claim that teeth must have *all* their opportunity for individual movement (so-called) unimpaired, in order to be safe. In studying cases for the '*Survey of Fixed Bridge Work,*' published in the *Dental Items of Interest* a few years ago, I learned one important fact; that the type of bridge which is fixed at one end only, and supported at the other end by a rest or lug, when of small size, and placed in cleanly mouths, on teeth of good integrity, whether vital or pulpless, with avoidance of mechanical irritation to vascular tissues, is capable of surprising service. I have records of such bridges of twenty, and one of twenty-five years' duration; and the abutments appear to be as sound as when the bridges were placed, or at worst, to have suffered no more deterioration than is common to all teeth of the individual mouths in which they stand.

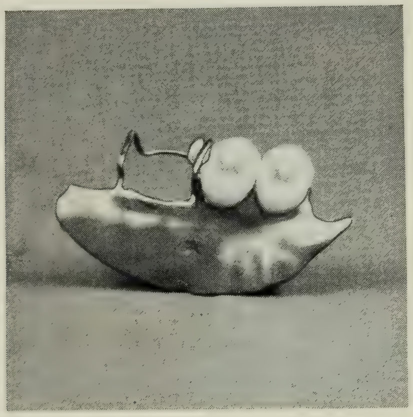


Fig. 259. Full crib clasp, soldered to saddle at each end. It is *not* attached to the lug, but lies free in a groove in its occlusal aspect. This clasp does not utilize torsional elasticity. It is of value *only* on bilateral dentures and bridges, and its illustration here, for convenience, on a unilateral bridge, must not be interpreted as endorsing its being so used in practice. Gauge 20 or even 21 will often be found heavy enough for this clasp, facilitating its use in close bites.

"I doubt not that present-day radiographs of the highest class will show evidence of tissue changes around and between the abutments, but I hold that evidence in slight esteem, as compared with the fact that the physical condition indicates vitality sufficient for more decades of service. I also gained a fresh realization, from the cases I contributed to that survey, of the unwisdom of any kind of extension appliance or attachment, to any tooth, in another class of mouths. I am well convinced that in mouths prone to sordes deposits, in subjects displaying evidence of intestinal toxemia, or of established organic disease, the uniting of two or more teeth, the mounting of a Roach attachment, or a Gilmore bar, the placing of a band of any type at the gingival margin—even the abnormal inlay contour that the most enthusiastic and painstaking removable, or movable-removable bridgeworker, occasionally seems to find necessary in order to include the box of his bridge attachment—often starts a train of events, that quickly brings the teeth involved to an intimate acquaintance with the forceps.

"The rigid and complete fixation of two or more teeth to each other I view with distrust, in spite of the cases on record of long service from such bridges. In the present state of my knowledge, after careful reflection, I am of the opinion that semi-fixation can be utilized in selected cases, with safety, provided cleanliness can be assured and traumatic occlusal stress reasonably well eliminated. It is not my intention, however, to argue in favor of general use of fixed bridgework.

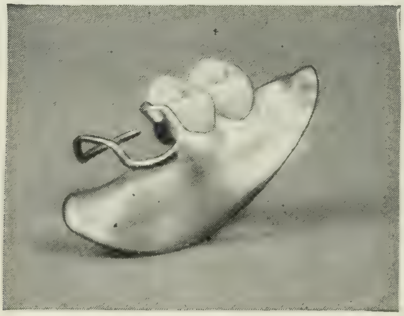


Fig. 260A. Cantilever saddle with modified crib clasp, attached nearly in the middle, antero-posteriorly, stabilizing lug in molar, and saddle resting against the cuspid. Note that pressure outward, as occurs when clasp is going to place, will induce torsion in the two perpendicular segments and flexure in all of its segments. (See Fig. 263 A and B.) In an unclean mouth, the rest against cuspid and lateral incisor should be by stiff clasp-metal fingers.

Partial Dentures.

"The partial denture has suffered in repute partly for the reasons cited in my comments on fixed bridgework; unintelligent planning, misuse of clasps, and lack of earnest determination to get the best out of it. Some of our abler practitioners have continued to use it, improving its plan step by step, since the days of Bonwill, who made the most notable early advance in supplying the so-called Bonwill lug, or rest, until today I consider it a competitor for the place of honor in partial prosthetic restorations. I believe that the same amount of energy and ingenuity that we have devoted to devising new bridge attachments, and learning to use them, if concentrated on improving the partial denture and its attaching and supporting devices, would have prevented it from ever falling into disrepute. We all know

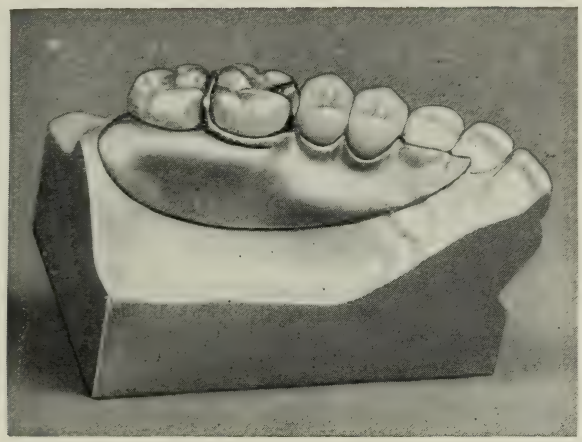


Fig. 260B. Palatal aspect of same bridge in place on cast showing point of attachment to the saddle, relations to palatal embrasure and to the groove cut in the region of the occlusal embrasure between the molar teeth.

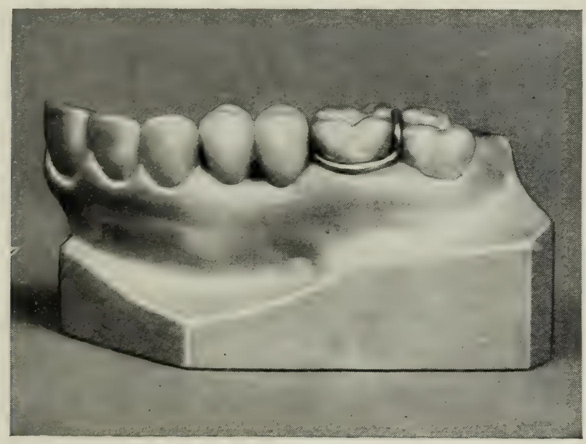


Fig. 260C. The buccal aspect of same bridge.

that a certain type of partial denture, without lugs, and with wide clasps placed near, or in contact with, the gingiva, has done and today is doing much damage, but that type of denture should have been obsolete long ago.

"One of the marked advantages of the denture bridge is the ease with which it can be repaired, if its only weak member—the clasp—needs that attention. To your sorrow, many of you know this is often not the case with the split attachments.

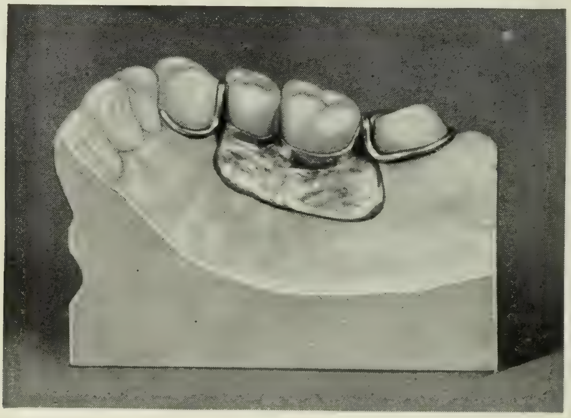


Fig. 261A. Lingual view of bridge supplying bicuspids and molars.

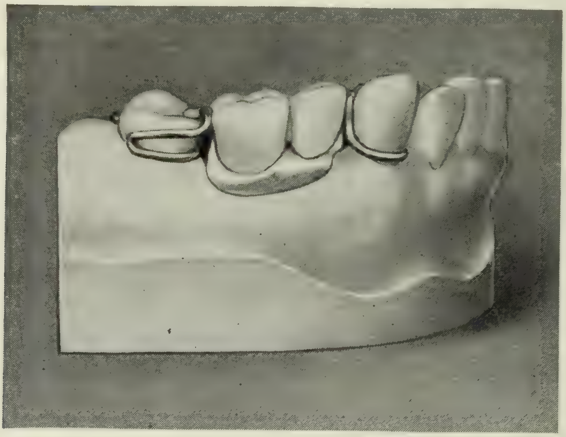


Fig. 261B. Buccal view of same bridge. Note how wire clasp is re-bent on itself, giving greater stability, and giving more spring to clasp.

"Dr. F. T. Van Woert helped me to come to my senses in this field, some years ago, when he said to me that he 'made very few large bridges of any kind for patients whom he desired to keep.' Dr. F. R. Getz (1), in 1916, and Dr. W. E. Cummer (2), in 1915, presented val-

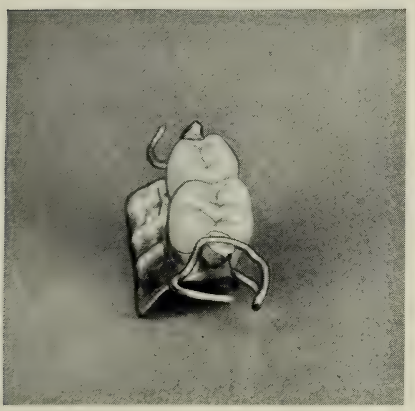


Fig. 261C.

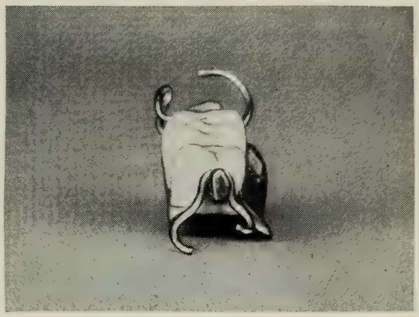


Fig. 261D.

Fig. 261C. Distal view of bridge showing clasp soldered to lug.
Fig. 261D. Mesial view of bridge showing clasp soldered to lug.

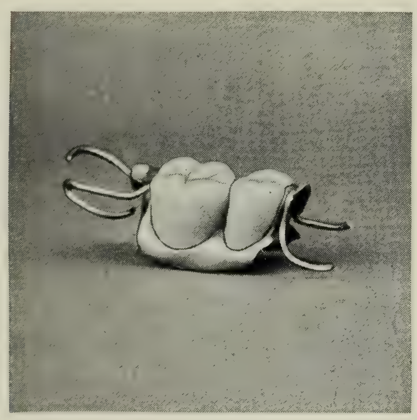


Fig. 261E. Bridge removed from the model. Buccal aspect showing clearer view of clasps.

uable articles on the technique of the partial denture, or partial denture-bridge, or bridge as I shall call it from now on.

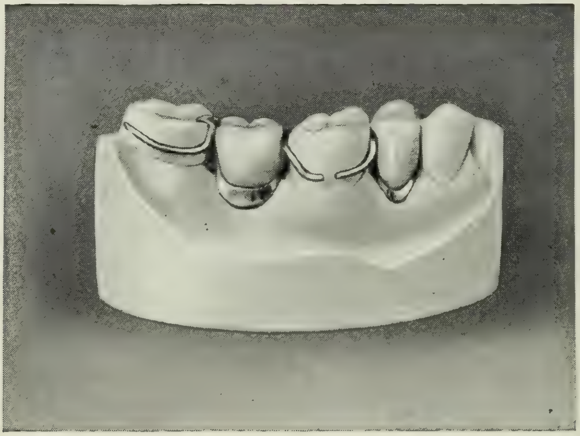


Fig. 262A. This bridge was designed by Dr. Kennedy to supply a bicuspid and molar, with a molar intervening between the two. He believes that in designing saddles, if there is no gingival pressure, there will be much less chance of injury.

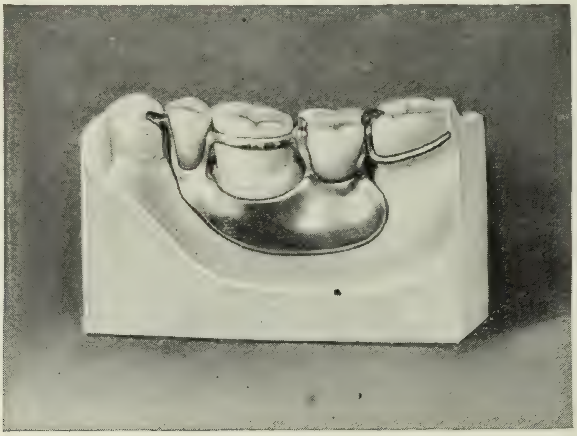


Fig. 262B. Shows the lingual view of the same bridge. The saddle is cut away from the gingival margin, and a wire is passed around the height of contour of the standing tooth, between the cuspid and bicuspid. This wire is strengthened with pure gold and solder.

The Bonwill Bridge.

"The so-called Bonwill bridge utilized, in a crude way, two valuable principles that are essential to this form of bridge, namely, the lug, or occlusal rest, and the clasp. The clasp was one of the earlier devices of dentistry; it still is one of our simplest, and can be made one of our most reliable devices. In conjunction with a correctly made lug, it is the retaining appliance that can be used in a great majority of instances, on natural teeth, with the least harm to them, either from operative interference with

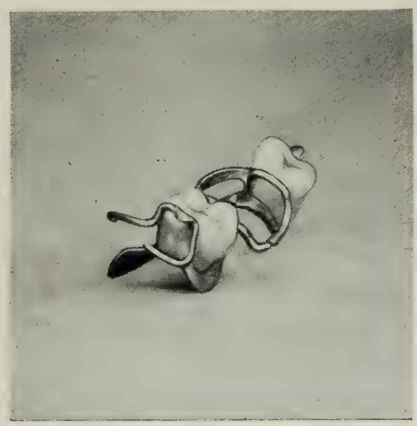


Fig. 262C. Appliance off the model showing the Gillett clasp and the modified Jackson crib. The bar on the lingual surface of the first molar is made of pure gold, clasp wire and solder. The pure gold is burnished against the tooth. The gingival margin is thus left free.

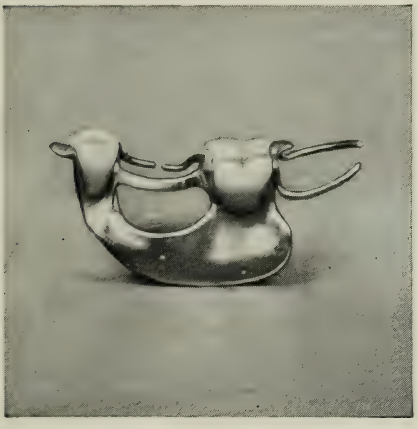


Fig. 262D.

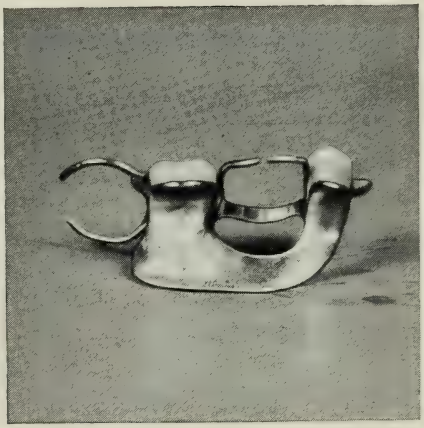


Fig. 262E.

Fig. 262D. Lingual view. Fig. 262E. Surface of saddle that rests on the gum. No contact at gingival margin.

their structure at the time of application, or from deleterious influence in the decades that follow. Moreover, if harm does follow the use of such a clasp, it is easily and simply repaired.

The Gillett Clasp.

"The clasp has fallen into disrepute for several reasons; wide flat clasps retain food and debris in contact with enamel, and induce decay; clasps of any sort impinging on gingival tissues, induce disease there; narrow clasps, without stabilizing elements for the artificial piece, cause grooves to develop at the points of contact, largely due to friction as the piece moves under impact of opposing teeth. Damage done by the narrowest clasp of all, namely, the round wire clasp, is the least deleterious and most readily remedied when the clasp has been correctly placed and a stabilizer added. It is also the one that can most easily have any prospective damage forestalled, if the exigencies of the case demand placing it at a point susceptible to caries, or erosion. It is the easiest clasp of all for the technician to shape, and the one that can have its point of attachment to the bridge farthest from the point where its grip on the tooth is desired, so giving opportunity for taking full advantage of the natural resiliency of the clasp metal. This latter fact renders it rarely necessary to use hinged attachments for such clasps, since it is usually possible to so shape and attach the clasp, that it can slip over the largest part of the tooth, or over somewhat malposed teeth, without deforming the clasp, thus avoiding interference with its fit at the point where fit is desired. Such clasps can be so placed when used on extension bridges, as to serve as efficient retainers, and still avoid 'pump handle' leverage on the teeth to which they have been applied.

"My first usage of this type of clasp, that I can now trace, was in 1905, and the idea was adapted from the crib clasp of the Jackson system of orthodontia. It was used to solve the problem of supplying missing molars on the left side of the mandible, without extending the piece beyond the left cuspid. The piece made then is still doing excellent service. In the same mouth is a bridge fixed at one end and supported at the other, placed there twenty-five years ago, still doing good service, and never having been disturbed since.

The Occlusal Embrasure.

"Study of the case will generally show that at some point there is room for such a wire to pass over the occlusal surfaces in a linguo- or plato-buccal direction, or that room can be made for it without material damage to the teeth. In case the restoration is of the two upper bicuspids, the preferred place for the crossing of the wire is in the occlusal embrasure, where the first and second molars approximate.

"This space, lying occlusally of the contact point of adjacent teeth, seems to have received no name from anatomists. After consultation with Dr. J. Leon Williams, Prof. Wm. J. Gies, Prof. W. K. Gregory, and others, I have decided to use the term 'occlusal embrasure' as being harmonious with buccal and palatal embrasures, the accepted terms for the spaces in similar relations to the teeth on the buccal and palatal aspects.

"If there is not room without impingment of the tips of the opposing cusps, these can often be shortened a bit without harm. In many cases fillings or inlays exist, or are needed in such places, and under this condition the grooves for accommodation of the occlusal segment of the clasp may be cut as desired, in inlays.

Lug Seats in Inlays.

"In a case of this type, the first step is to provide, in the mesiocclusal aspect of a first molar for instance, where nearly always there is already a filling of some kind, an inlay having in its mesiocclusal or distocclusal aspect a lug seat approximating a rectangular form, but tapering a little from occlusal to gingival aspect. This lug seat may vary in width and depth, according to the space available, provided only that its cross section assures strength to withstand the stress which the thrust of the jaw muscles will impose. Its floor should, preferably, slope away from the mesiogingival margin of the lug seat, so that the tendency will always be for the lug to remain in its seat. In occasional cases a dovetail shape of the lug recess, in cross section, is permissible or desirable, to meet any tendency for the lug to slide out.

"The inlay with lug recess having been made, preferably by the indirect process, the lug to fit it is made immediately of a hard gold, such as Ney-Oro C, or preferably F, and left unfinished, with a bit of the sprue wire still projecting from its surface. Meantime the saddle has also been prepared from a suitable impression, and inlay, lug and saddle are taken to the mouth and a plaster impression taken with saddle under pressure (or the membrane blanched with adrenalin, if preferred) to obtain the relations of saddle and lug. When these have been united, they are placed in the mouth, and an accurate plaster impression is taken, from which to make a stone model for fitting the clasp. This model should show perfectly the occlusal embrasure or groove, in which the clasp is to lie, and, of course, the parts on which its other segments are to rest.

Technique for Making Clasp.

"In forming the clasp for such a tooth, place the saddle in its seat, and start a segment of the clasp along its margin, where it lies in contact with the palatal aspect of the tooth. With round or half round pliers, turn it sharply towards the occlusal surface, and shape it so that mesiodistally, it will stand in the centre of the palatal embrasure, well in towards the contact points of the teeth, but preferably not in actual contact with the teeth. Again bend it sharply, so as to have its next segment rest in the embrasure across the occlusal aspects of the teeth, and then again bend it gingivally, so that it will stand in the buccal embrasure as described for the palatal embrasure segment. Next carry it along the buccal side of the molar, at the desired location, but always gingivally of the height of contour on that aspect of the tooth. If the tooth is one so placed as not to be unduly visible, the wire may be recurved upon itself, to form an open loop, with the final segment placed occlusally of the buccal height of contour of the tooth, and the end left free. This sometimes adds to the stability of the smaller saddles.

"Perfect this form, and if you are going to attach it to the saddle without another impression, which can often be done, place a layer of heavy tinfoil in the groove, where the occlusal segment rests; fit the clasp carefully to place, seeing that it bears against the teeth in the lateral embrasures but slightly if at all, and that it never rests in a worn, or chipped place in the model at those points. This precaution is to prevent the clasp from riding hard where not desired, when taken to the mouth. The tinfoil serves to lift the clasp slightly away and, after attachment, results in the same relations of clasp, saddle and the tooth, as if an impression had been taken under pressure. Note carefully the position of the clasp where it rests against the saddle, and in the groove; lift it off and bend the buccal segment buccally, so that it will not prevent removal of the saddle, when waxed to it; replace it in position; attach to saddle with sticky wax; remove, invest, solder palatal end of clasp, and bend the clasp back to form. This provides a long, resilient clasp of great efficiency, and especially adapted to molars, because of its capacity for bending slightly and evenly through its whole length, and returning to its original shape. If the model used for this step is a good one, and a bite has been taken, no further impression is necessary for the finishing of the piece.

Supplying Molars and Second Bicuspids.

"In bridges supplying molars and second bicuspids, where a lug and clasp can be used at each end, the clasp is preferably made and attached, after every other part of the bridge is finished, except the cementing to place of the porcelain. A groove is formed in the occlusal aspect of the lug; also in inlays, if necessary. The clasp is then fitted and soldered to the lug, on its occlusal aspect, leaving each arm composed of two segments. If the buccal arm of such a clasp would be too much in view, it may be omitted, the lug made as deep occluso-gingivally as may be safe, and the clasp effect gained by grip of a palatal clasp arm opposed to the lug when in its seat. In the lower cuspid region there is nearly always room for the clasp to go between the occlusion, distally of the cuspid, and there I always let the buccal segment end in a Y-form, to rest on both cuspid and bicuspid. On lower bicuspids a rest on the occlusal surface of the enamel, without recessed inlay, is sometimes sufficient, but the stabilizing influence of the rectangular lug is of great value. (Figs. 258A, 258B, 258C and 258D. Also see Fig. 259.) Figs. 260A, 260B and 260C, show a case duplicating in principle one where room for a molar clasp was gained by cutting a groove into the gold occlusal surface of an already placed lower fixed bridge. If erosions are present, or decay menaces at a point in the buccal surface where it is desired to have a clasp of this type rest, a shallow inlay can readily be placed, and will provide adequate protection without risk to the tooth. (Figs. 261A, 261B, 261C, 261D, and 261E.)

Advantages of Gillett Clasps.

"There are many variations possible with this clasp, making it the most adaptable of any attachment that I know about. It is easier to form and to fit nicely to a tooth than would be the case if half-round wire were used, and the risk of its inducing enamel decalcification because of acidulous sordes collection inside the clasp is reduced to a minimum. I do not now recall a case where decay had started under these clasps, for this reason. The possible variations of this combination of clasp and definitely shaped occlusal rests are innumerable, and the ease of repair in case of breakage is an important advantage.

"Without sacrifice of any of the enumerated advantages, the saddle may be given any desired form, released from all contact with the teeth or gingival margins, extended over areas where stimulation of the gum is desired, and the clasps and lugs so shaped and proportioned as to have the saddle both stable and movable. See Cummer's article (2) for elaboration of this thought. Stability equal, or superior, to that of other bridges is readily obtainable. (Figs. 262A, 262B, 262C, 262D and 262E.)

"I believe that earnest and intensive study of the principles emphasized in this paper will prove their adaptability for from 70 to 80 per cent of the partial prosthetic restorations we are called upon to make, and that their use will result greatly to the advantage of our clientele. If this be true, the welfare of the dental profession will also be advanced by such a course. At the present time a reputation cannot be built, or conserved, if procedures are advocated and practiced that lead to the early incidence of either pulp or pericemental disease, and too often these are the results of all forms of movable bridgework supported by split attachments engaging in gold inlays."

Wire Suitable for Clasps

"Most of the clasp wire available in past years has been of a quality inadequate and unreliable for this work.* Other than what has been made by a small number of manufacturers, the product has lacked uniformity, and has very steadily presented one of two fatal defects:—either it has been so soft as to have no adequate resiliency, or else it has been so poorly managed in the alloying process as to be brittle, and consequently unreliable, and with both of these conditions, a third defect may have crept in, due to inadequate handling of the wire at the time of drawing it.

"The joint work of the U. S. Bureau of Standards and the Weinstein Research Laboratory is bringing about a clearer understanding of these factors, and we shall eventually arrive at definite knowledge of formulæ required for any particular service, our manufacturers will have determined a technique necessary to obtain a uniform product, and we shall be able to apply definite and standardized tests to the product delivered.

"I am told that this work at the Bureau of Standards has been viciously attacked by a few dentists and manufacturers, both as to reliability and as to its being accessible to all who desire to use the information. It is a privilege to say that my contacts with the Bureau have convinced me that the most extreme care is used to avoid placing the stamp of approval on any research results until it is certain that they are correct. The Bureau has a reputation for accuracy that must always be maintained, and it is meticulous in its care to do this.

"Likewise, it is a pleasure to be able to say that the results of the research in this field are open to every dentist and every manufacturer who cares to avail himself of them and use them in good faith. This is well known to be the status of all Bureau of Standards research.

***Journal of Dental Research,* September, 1927.

Elasticity in Clasp Gold.

"For efficiency in a wrought clasp, elasticity is an essential property of the material to be used. There are two forms of elasticity available for the use of the clasp technician, but only one of them has commonly been used by him in past decades.

"Both of these are governed by laws of physics, which have been unknown to most dentists, and consequently they could not influence clasp practice. It has been comparatively recently discovered by the research work above referred to, that elasticity can be materially influenced by correct heat treatment; that gold alloys of certain formulæ can be made to assume a maximum degree of softness by processes of annealing, and later to assume a maximum of elasticity by heat treatment, both processes being easy enough to apply in the dental laboratory.

"The encyclopedias use the term 'perfect elasticity,' by which they mean capacity to display elasticity within the limits of the factor of safety of a particular specimen of any elastic material, an innumerable number of times and still return exactly and completely to the original form. The typical example of perfect elasticity of flexure, is the hair spring of a watch, capable of expanding and contracting a certain distance millions of times, without taking on a new form, or set. We all realize, however, that if we expand the whole spring too far, or if we flex a short segment as far as the long one can be repeatedly flexed without deformation, it will set in another form, and not return to the original. In other words, the longer the spring (clasp) the further it can be flexed without permanent deformation. The *important* thing in our study is not how *far* the longer spring can be flexed but in the factor of safety resulting from that capacity. If a short clasp can be flexed one thirty-second of an inch only, before taking on permanent deformation, while a long one can be flexed three times as far without doing so, then it will be possible with the long one, to duplicate the conditions of the watch spring, and to bend it the required one thirty-second of an inch a great number of times without damage. This, translated into practice, means 'make your clasps as long as you can,' whenever you desire permanence of the elasticity factor.

"The governing laws are: 'deflexion varies as the third power of length,' and again: 'deflexion varies inversely as the fourth power of diameter,' and translating this into practice, we find that the smaller the wire, and the longer the clasp we can use for a particular case, the greater the deflexion possible, and consequently the greater the factor of safety for a slight deflexion. This, in turn, calls for a wire of the highest possible elasticity, and the greatest adaptability to heat treatment, because a small wire, with these qualities, will have the same retention value as the larger wire without them, and, in addition, can be depended upon to display the required degree of deflexion to permit the clasp to pass over the contour of the tooth, and close up again to the desired smaller size, a great number of times without permanent deformation and consequent loss of retention value.

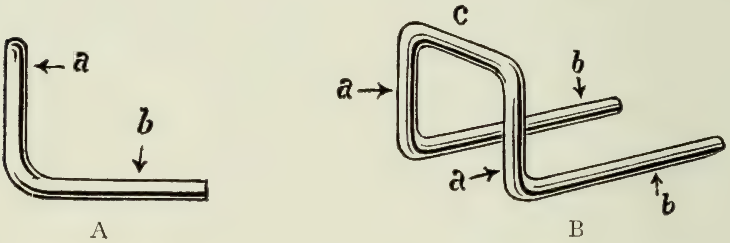


Fig. 263.

Fig. 263. Diagram explanatory of flexure and torsion. A. When the arm "b" is bent upward or downward, deflexion occurs in both "a" and "b." When the arm "b" is bent outward, or away from the tooth (as when passing over the height of contour), deflexion occurs in "a" and "b" and torsion in "a," the two forces combining to restore the arms to their original position. B. This diagram is composed of two parts similar to A, united by the bar "c." Of course, the clasp is a single wire bent to this form. The action of the concealed forces are the same, except that now when the arms "b" are bent downward or upward we have the added force of torsion in the arm "c," operating to restore it to its original position; and when the arms "b" are bent outward from the tooth, we have the forces previously described, plus deflexion in "c."

"Torsional elasticity is in common use by orthodontists, and a domestic device in which it is displayed, is one of the springs for closing screen doors, where a rod 2½ ft. long is rigidly fixed to the door at its lower end, and to the casing at the other, in such a manner, that opening the door produces torsion of the rod and the elastic force so developed, closes the door as soon as it is released. Here again, we have a factor varying inversely as the fourth power of the diameter, but in direct proportion to the length, and this supplies a further reason for demanding a wire capable of displaying the utmost in resiliency. Hence the small wire, with the large factor of safety, may have the requisite retentive capacity.

"Mr. R. L. Coleman, who reported the results of the research in this field by the Bureau of Standards and the Weinstein Research Laboratory in a paper published in the May, 1925, issue of the *A. D. A. Journal,* has calculated for me the comparative values of the two forms of elasticity, with very interesting results. I had been prepared to find that the net gain from the torsional elasticity factor was comparatively small in practice, but I was well convinced by clinical experience that it does exist, and that it adds to the efficiency of clasps so designed as to permit of its exhibition. The calculation was made on the assumption of equal length of two segments of a piece of wire, so bent that the segments should stand at right angles to each other, one end being held rigidly while force is applied to the other end, as in the case of a clasp going over the contour of a tooth. Under these conditions, torsional elasticity comes into action in one segment and deflexion elasticity in both. The calculations indicate the value of the torsional elasticity of the one segment to be slightly greater than the deflexion elasticity of both, but with a greater factor of safety for the torsional form. (Fig. 263 A).

The Application of Torsional and Flexure Elasticity in Clasp Construction

"Let us now consider the result of application of these laws and principles to round wire clasp design and practice.

"The common practice has been to use a short clasp—often the shortest possible—and to so attach the clasp as to call into play only the elasticity of deflexion, or if there was any departure from the shape of the clasp or the position of the attachment from that imitating those features of flat clasp practice, it was usually so slight, that opportunity for display of torsional elasticity was practically non-existent.

"Until very recently, adaptability of gold formulæ to heat treatment has not been considered at all, and almost any spring wire was supposed to be satisfactory. Let us take, as an example, a clasp attached to a saddle and intended to bear on the side of a bicuspid next adjacent to its point of attachment, and assume that its resiliency is just short of that required to permit going to place without permanent deformation resulting, and see what will happen if we double or triple its length, which is not extreme, because it is easy to provide for that much additional length and if it be required, elongation to four or five times that of such a clasp is usually possible.

"If we double the length, but retain the same principle in form design—i.e., extend it around the tooth in a single plane, the available deflexion resiliency, will compare as the third power of the length—i.e., it will be eight times as great, while it will be twenty-seven times as great in the clasp of triple length. This use of total clasp length for our calculation, applies only to the clasp which encircles the tooth in one plane, which is not usually desirable. When the design dictated by sound practice is adopted, with two or more segments standing at, or approaching, a right angle to each other, the total deflexion capacity is the sum of that exhibited by the segments individually, so that in the clasp of double, or triple length in segments, each equal to that of the short clasp, the deflexion factor will respectively double or triple; but if any one of those segments can be made longer, then its contribution will be as the third power of its length when compared with that of the shorter segment.

"When effort is made to design a longer clasp, the form that commonly emerges, is one in which one or more segments stand at approximately a right angle to the terminal segment of the clasp. In practice the force tending to expand the clasp is applied to the inner surface of this terminal segment, and the result is to produce torsion of the segments standing at any considerable angle to that terminal segment, so calling into service torsional elasticity direction, proportional to the length of the segment in which it is operative, but having in equal lengths of the same diameter of wire, a value for the available torsional elasticity, approximating twice that of the deflexion factor, and consequently a greater margin of safety. (Fig. 263 B.)

"But this is not all we may do to increase our clasp efficiency. If we select a wire with a formula amenable to heat treatment, by which I mean one that becomes very soft when correctly annealed, and very rigid and resilient when given correct heat treatment, we find that we can reduce the gauge of wire required by two, and frequently three, sizes. Deflexion capacity (equivalent for our purposes to elasticity) varies inversely as the fourth power of the diameter and when applied in practice to wire of B and S gauges, works out as follows:

"If, in place of 16 g., of a certain make of wire, which I have habitually used for many years for one type of clasp, there can be substituted 18 g. or even 19 g. of another wire, (either of which may be found desirable,) then in the case of 18 g. the deflexion capacity will have been more than doubled, and in the 19 g. nearly tripled, as compared with the 16 g. of the *same* wire. It is self-evident that we cannot state the gain in figures as compared with the 16 g. of *another* wire, but we can and have tested samples of the two wires of the same gauge, and have found the new wire more amenable to heat treatment, and when so treated to be decidedly superior in capacity for repeated deflexion without injury. Hence we may confidently assert, that this ability to use a wire at least two gauges smaller, is an important advance in clasp practice, because it enables us to further safeguard clasps against probable deformation, and thus to increase the certainty of long and efficient service. The tests show the newer wire to be capable of withstanding three times as many deflexions as the older one, before failing.

"Let us revert to my previous reference to our failure to apply adequate analysis and ingenuity to the problem of eliminating the objections to, and improving of the efficiency of the round wire clasp.

"A major part of the factors which I have so far mentioned, were unavailable to us until quite recently. It is probable that even ten years ago no metallurgist with the necessary grasp of dental technique, would have been found willing to make the requisite tests and experiments leading to the development of new and better formulæ, adequate for solving the particular features of the problem to which I have so far referred, even if a manufacturer with the requisite foresight, equipment and metallurgical skill could have been interested. It also seems quite certain, that as long as ten years ago, enlistment of the coöperation of the Bureau of Standards, out of which has evolved the knowledge fundamental and necessary for the progress in metallurgical practice and technique, to which I have referred, would not have been feasible.

"The facts above cited, did not prevent the occasional dentist from making tests by the time worn trial and error system, as to the possibilities of better results with round wire clasps, than those which had characterized earlier efforts, and these men found that even with the better examples of the wire available 25 or 30 years ago, they could, by imitating and modifying the crib clasp of the Jackson orthodontia system, add materially to the value of what was then partial denture service. The speaker was using modified crib clasps, such as are shown in Fig. 258 to Fig. 261, in the period referred to, and had occasion to be gratified by the superior service of the longer clasps, and thus learned by the somewhat painful process of trial and error, that within reasonable limits, the longer the clasps, the greater the efficiency and reliability. The fundamental laws governing this fact were not clear, until opportunity came to confer with the Bureau of Standards experts, but practical experience had, fortunately, led me along the right road as regards clasp design, although the still better understanding of fundamental principles which I now have, adds to the facility with which I can demonstrate those advantages to others.

"I have already alluded to the fact that, commonly, the round wire clasp has been designed for the minimum feasible length, and this continues to be true, even in present day practice, partly because practitioners have failed to properly evaluate the application of a sound mechanical principle, which has been urged upon them by technicians, or by operators whose position seems to have been dominated entirely by the mechanical aspect of the situation, without much regard for the comfort of the patient, and with no consciousness of the possible existence of principles in clasp practice other than those governing the selection of the point where the most efficient grip of clasps can be most easily demonstrated, apparently forgetting that the introduction of stabilizing lugs has reduced to a minimum the need for heavy grip of clasps.

"Speaking solely from the viewpoint of the bench technician, there can be no question but that the place to readily get an efficient grip on a tooth with a clasp, is slightly rootwards of the line of the height of contour of the involved tooth, and, if a short clasp is to be used, this is the feasible place for it, because this location does reduce the need for display of any large degree of elasticity. The objections made by patients, when this location was selected for round wire clasps in particular, very naturally and very properly caused practitioners to decide that clasps so located are unsatisfactory, and unfamiliarity with the laws of elasticity, which I have set before you, or in lieu of this, lack of initiative to search for and discover by practice the steps requisite for placing the bearing segment of the clasp at the neck of the tooth, where it belongs, if the patient's comfort is to be considered, resulted in discarding one of the best, if not the best, device available to us, both then and now, for the effective retention of partial dentures and bridges.

Exceptions to the Rule for Locating Clasps.

"I desire to note here three exceptions to the dictum stated above that such a clasp should be located just rootwise of the height of contour. The first of these is in the case of partial dentures in which the principle of stimulation of vital processes is to be utilized for the health maintenance and regeneration of underlying bony structure, which was so admirably demonstrated and explained to me first by Dr. George P. Phillips.

"It is my understanding that an essential feature of that system, is absence of lugs, or rests, for thrust resistance, so that the full force of the bite thrust, shall be sustained by the tissues underlying the saddle. Obviously, under this condition, the clasp must rest on the tooth, well away from the gingival margin, and frequently high enough to approach the height of contour, in spite of the inconvenience it will cause the patient by its location at a point obtrusive to the tongue.

"The second exception is in the case of leaning teeth, where the utilization of all the advantages available to us through application of the laws and principles of elasticity, will not permit placing the clasp anywhere, except as near the occlusal surface as is compatable with obtaining adequate retention. Here again the patient must submit to inconvenience, if a clasp is the indicated device. Most of these latter cases fortunately lie in the mandibular molar region, and the combined effect of their posterior location, and of the prominence of the linguo-occlusal surface of the tipped tooth, reduces the annoyance to a minimum.

"The third exception, is in the case of the full crib clasp, of small gauge wire, sometimes useful on bilateral pieces, which will usually require the location of the bearing segment of the clasp only slightly rootwise of the height of contour; but it happens that the only cases in which this clasp would be used, are those which bring that part of it on the buccal surface, and the small size of wire required in all these instances, reduces the objection to it close to the vanishing point.

"The question of whether the location of the bearing segment of such a clasp, just rootwise of the height of contour, is the one for demonstrating its greatest efficiency, is ordinarily strictly an academic one, because the utilization of the principles which I have called to your attention, so increases the efficiency of the round wire clasp, as compared with the shorter clasps that are commonly advocated by those who would insist upon that location as the correct one, that they are in every way superior to such short clasps.

Correct Location for Clasps.

"The correct location for the horizontal segments of round wire clasps on teeth having normal gingival tissues is in the angle formed by the junction of the tooth surface and the gingival margin, as close to that margin as is feasible, with certainty of freedom from impingement upon it. At that point, it can always be made so unobtrusive to the patient as to be readily accepted.

"When I make this statement, the question is always asked—'What about clasp relations to incipient decay, or erosions in those locations?' The answer is that if neither of them has already begun, and your piece is properly stabilized, you need have no hesitation on that score, in so locating your clasp, and if either of them *has* already begun, then restore the normal shape of the tooth with a shallow gold inlay before you take the impression for making the cast on which the clasp will be formed.

"It is desirable to say emphatically, that when small gauge wire is to be soldered, it should be a wire with a high melting range, for two interrelated reasons. The higher the melting range, the greater the margin of safety between the fusing point of the solder and the wire, and since the small wire very quickly takes on the maximum temperature of the blowpipe flame, it is easy to damage it inadvertently.

"Further than this, however, is the recently discovered and as yet incompletely investigated fact, that such a wire may be badly damaged and rendered incapable of displaying its best qualities, at a temperature enough below that where it completely fuses, so that there will have been no evident outward change.

"Before beginning the shaping of a clasp, have at hand numerous forms of smooth beaked pliers, of assorted sizes and shapes, and see to it that any pliers with angles on the beaks, are placed out of reach, because the wire for this use must never be scratched, nicked nor deformed in its cross section, and handling it with pliers with sharp corners, always ruins it. Wire so damaged must be discarded at once.

Heat Treatment of Clasp Wire

"Now, a few words about heat treatment. All I have to say about this feature has been drawn from the paper of Mr. R. L. Coleman, printed in the May 1925 issue of the *N. D. A. Journal.*

"For elastic wires of formulæ suited to clasp practice, i.e., capable of displaying a high degree of elasticity, and yet capable of extreme softening under proper annealing, the correct procedure is as follows:—Provide yourself with an electric oven, capable of developing and maintaining temperatures up to 1000° F., with an efficient temperature indicator, and a rheostat control, effective for any temperature below that, down to 400° F. Some of the desired results can be made available by the use of the blowpipe and home devised apparatus, but with such procedures, the apparently essential feature of *uniformly graduated* and time controlled cooling is not feasible; hence it seems undesirable to attempt their description, since a suitable oven will soon be available.

"The annealing may be done by heating the wire to a cherry red, in the Bunsen flame, and quenching it instantly in water or acid, which will develop its softest condition. Care should be taken not to heat above a cherry red, as this may ruin the wire, and in soldering wire of this type, care should be taken to use as low heat as possible. The best grade of such wire, can be soldered with 22 K. solder without damage, if the heat be kept as low as will serve to fuse the solder adequately.

"The shaping having been finished, all soldering completed and relation to cast verified and corrected if necessary, the piece should be boiled in 30% nitric acid and then heated to 900° F. in the oven, and held at that temperature for ten minutes, the heat cut off, and the piece allowed to cool gradually in and with the oven closed, down to 400° F. This should take at least 15 minutes, and with some formulæ as much as 30 minutes is permissible. Some other formulæ on the market are ruined by the longer period of cooling, as it causes them to become very brittle. The minimum of 15 minutes *uniformly graduated* cooling period is imperative, so far as present research has determined, but variations of as much as 100° in the temperatures stated, are of less importance. Below 400° F. temperature changes do not in any way modify the physical properties."

References to Literature

1. F. R. Getz, 1916, *Journal of the American Dental Association,* page 735. "The Use of Clasp and Lug Attachments for Short Bridges and Partial Dentures."

2. Dr. W. E. Cummer, 1915, *The Journal of the Allied Dental Societies,* Page 386, "Partial Dentures." *The Journal of the American Dental Association,* Vol. IX, page 735. "Outline of Theory and Practice in Partial Dentures."

CHAPTER XIX

The Jackson Crib Clasp Technique

Next to the Gillett clasps, the Jackson Crib clasps, in my hands give the greatest satisfaction.

Dr. Jackson told me that he invented the Jackson Crib clasp for dentures before he had any idea of using them in orthodontia. They are practically the only type of clasp we can use in Class II and Class IV cases. They require the least amount of mutilation of the teeth, and even in the closest bites, it is not necessary to remove more enamel than to allow the placing of a 19 gauge wire. This need not all be taken off one tooth; half the width can be taken off the embrasure, and the other from the cusp of the opposing tooth which bites into the embrasure.

They wear very quickly if they are opposed by a porcelain cusp of a crown or denture, and precaution should be taken to see that they clear when they are placed in these positions.

These clasps are the most difficult to make if the technique is not exactly followed. No step can be overlooked, and one step must follow the other in exact order, because it will be impossible to retrace our steps and get a successfully fitting clasp.

I have seen Dr. Jackson bend these cribs in less than five minutes, and those shown in the illustrations were bent by Dr. Joseph Eby, who was once associated with Dr. Jackson, and I believe they were all bent in less than five minutes. Dr. Eby kindly supplied me with the photographs on the technique for this chapter. If the student would obtain some phospho-bronz wire, manufactured by Patterson Bros., 27 Park Row, New York City, and practice making these cribs, first annealing the wire, which is very soft and can almost be bent with the fingers, and then bending it annealed which works very much like the ordinary clasp wire, it would be excellent practice and of great assistance when he comes to make the final clasps.

I have constantly decried the modern tendency of dentistry to adopt things which require little technical skill. I know nothing today that gives me more pleasure than to bend a nicely fitting clasp at the laboratory bench.

After we have obtained the study models, we determine where we want to clasp with a Jackson Crib and the ideal method is to bring the patient in, and take a small impression of these teeth, pouring the model in ordinary casting plaster. For some reason clasps seem to fit very much better if they are bent on an ordinary plaster model. If they are made on a stone, or amalgam model, they do not fit so snugly. This is not only my own opinion but Dr. Eby's and Dr. Jackson's.

In diagnosing the position of the tooth to be clasped, always try to select one where the embrasure is wide enough to receive the wire without grinding. This is done by taking a piece of wire of the gauge we intend to use, (the phospho-bronz wire is good for this purpose) placing it between the teeth and having the patient close. Sometimes it is necessary to bend the wire, so that it fits down in the curve of the embrasure. If we can close the teeth it is not necessary to grind, but if it is decided to do any grinding, this should be done before the impression for the clasp is taken. It always engenders suspicion in the mind of the patient if we must do the grinding after the work is finished. and the fit is never so good.

I have tried three different ways of bending these wires; one by bending from the middle of the wire towards the ends; one by swaging, and one by following the Jackson method, which I am describing. By the first method it is impossible to obtain an accurate fit. The second obtains an accurate fit, but requires about one and a quarter hours for the average clasp. Of course this includes the time necessary for the setting of the plaster. It has some value in the heavier wires which are used in surgical cases, but for the average practitioner, it is a waste of time. On numerous occasions I have seen Dr. Eby bend a wire in less than five minutes. In my laboratory it is done in about ten minutes. I was trained in my gold work by three men who were competent jewelers and none of them wasted time; there were no false motions. One of them, before he studied dentistry had been the output manager of the largest watch factory in this country. He always worked with a clock on his bench and played a little game with himself. If he took seven minutes to bend a clasp today, he tried to do it in seven minutes or less the next time, and I have never seen a man who took greater joy in working than he did. He always used to say to me; "Don't fiddle."

The Jackson Technique

It is a rule in bending clasps, that if a pattern is made, it is best to make a pattern of the same gauge as the clasp to be fitted. This applies either to wire, or to flat plate clasps. Those men who do not want to waste their gold, should make a pattern and the phospho-bronz wire should be selected and bent to shape. This can be done with the fingers and one pair of pliers, preferably the Peeso collar pliers. It is not necessary to have a large number of pliers. I only use four pliers: the Peeso, the Aderer, the Nesbett and the Bernard. It is essential to have a Nesbett pliers for this work. The Bernard side-cutting pliers must have the rough edges and surfaces ground off smooth, so that the gold will not be marred.

It is here that the plaster model is of assistance to us. The Jackson Crib, when bent on a stone or amalgam model, never seems to fit close to the gum, and it is desirable that it should do so. Both ends are rigidly held and rest upon the occlusal embrasure and cannot settle and impinge upon the gum margin. So we find that if we trim the plaster model along the gingival margins of the teeth, about the thickness of the wire we are to use, we will have a better fitting clasp.

The Jackson Crib need not fit tightly on the buccal surface. It gets its hold, by gripping in the interproximal space and not over the bulge of the tooth on the buccal surface, although if it fits snugly on the buccal surface, it is more comfortable to the cheek.

A piece of gold wire is cut to the same length as the pattern. We place it upon the model to see just where we must make the first bend (Fig. 264), and grasp it at this point with the Peeso pliers (Fig. 265), and bend, but not overbend; try it back on the model as in Fig. 266A, to see if the bend fits in the embrasure. We next bend the wire to fit the gingival margin, trying it on the model and grasping it with the pliers at the point where it begins leaving the surface of the tooth, bending the free end of the wire with the fingers. (Fig. 266B.)

Now if we have bent our clasp nicely to fit the contour of the tooth, we grip the wire in the same manner as shown in Fig. 265, with the Peeso pliers, and make the second upright bend. We will now have a U-shaped piece of wire. Placing it on the model in position to see that it properly fits and holding it firmly (Fig. 267), we grasp it with the Peeso pliers at the junction of the interproximal embrasure with the occlusal embrasure (Fig. 268A), bend it over with the fingers (268B), and again try it on the model to see that it fits into the occlusal embrasure

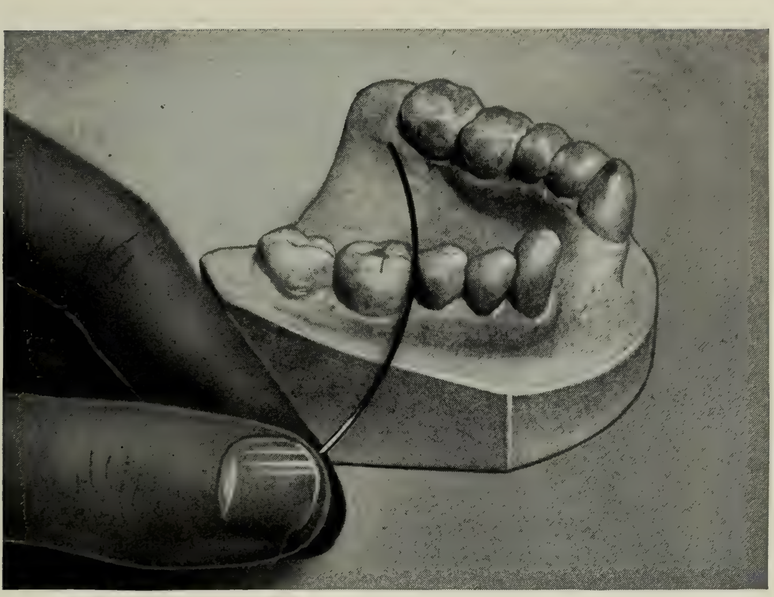


Fig. 264. Wire held in position to measure length of bend.

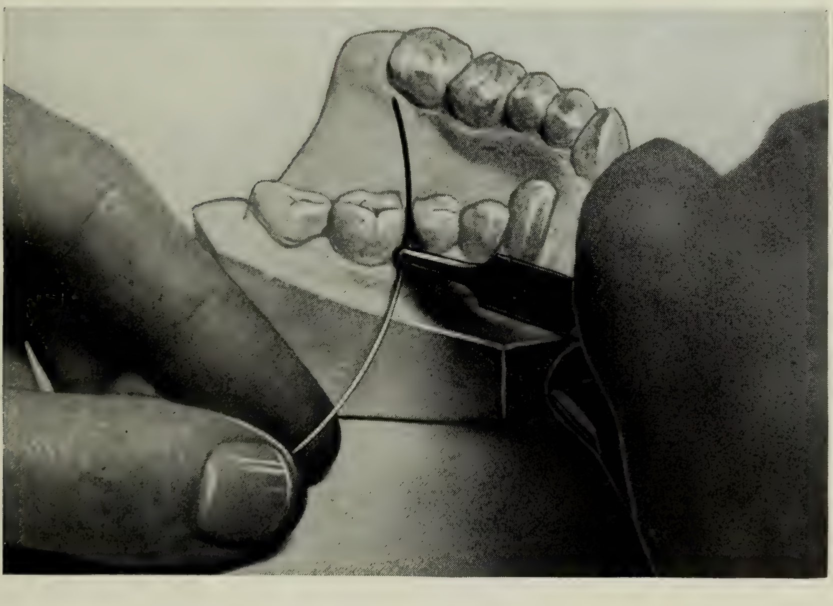


Fig. 265. Peeso pliers placed at point of bend.

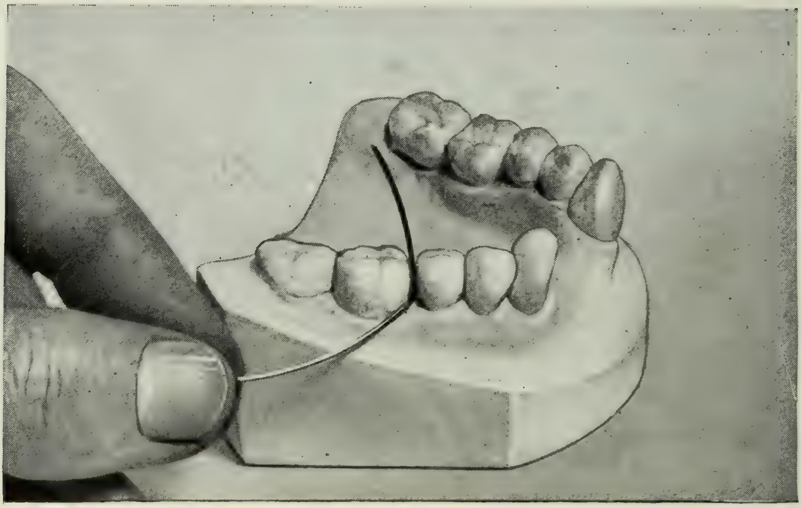


Fig. 266A. Wire bent and tried into position to see if it fits the embrasure.

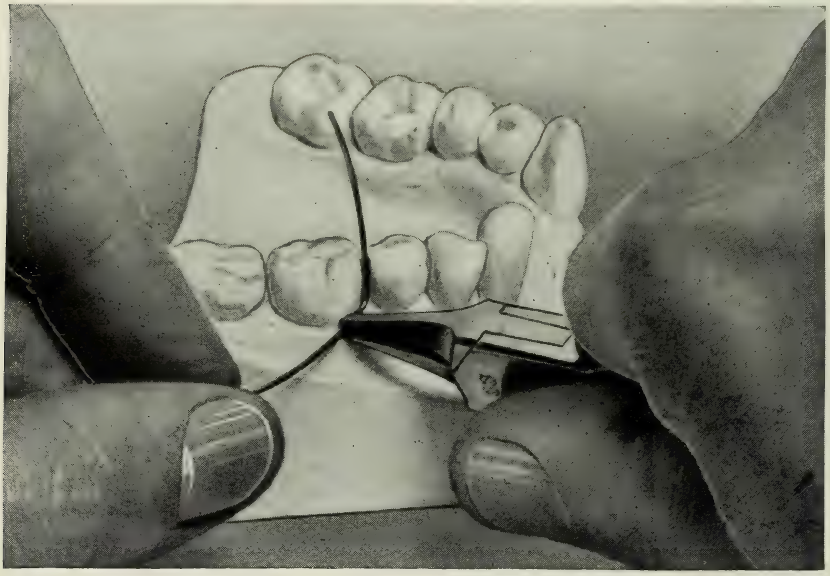


Fig. 266B. Bending wire to fit contour of tooth at gingival margin. Grasp the wire with Peeso pliers at the point where the wire leaves the contour of the tooth, and then bend with the fingers. This places less strain on the wire than when bent with pliers.

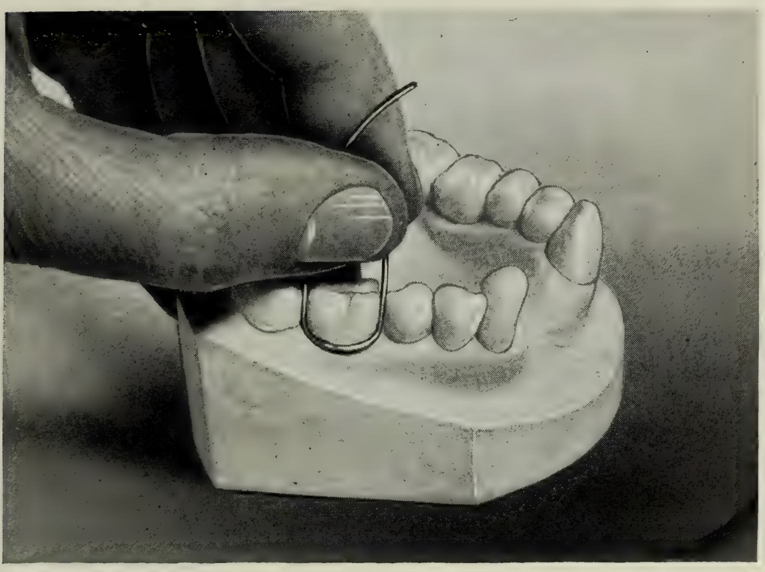


Fig. 267. Wire bent to contour of gingival margin, and bent in U-shape, to fit in the other buccal embrasure.

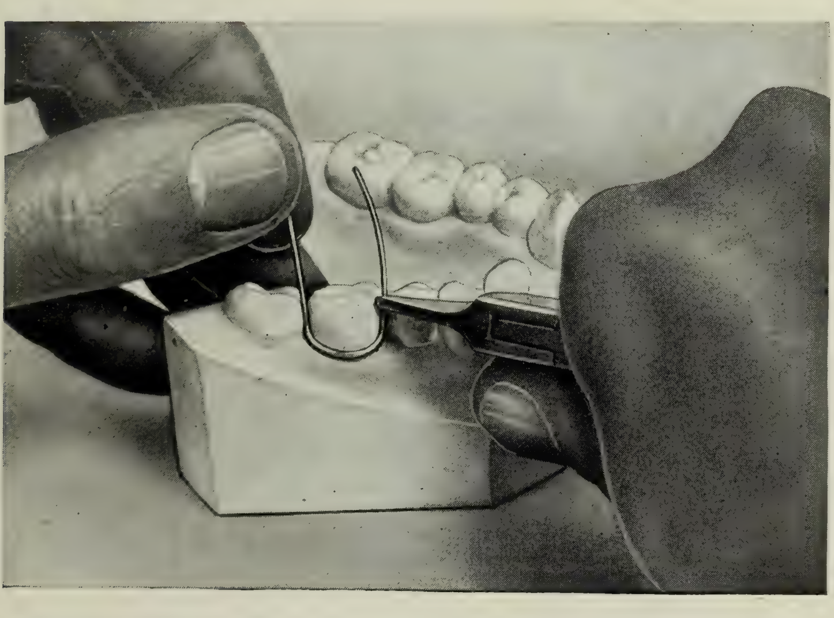


Fig. 268A. Pliers placed at junction of buccal and occlusal embrasures to make occlusal bend.

as shown in Fig. 269. At this point it may be necessary to concave this wire to fit into the occlusal embrasure, as some occlusal embrasures are

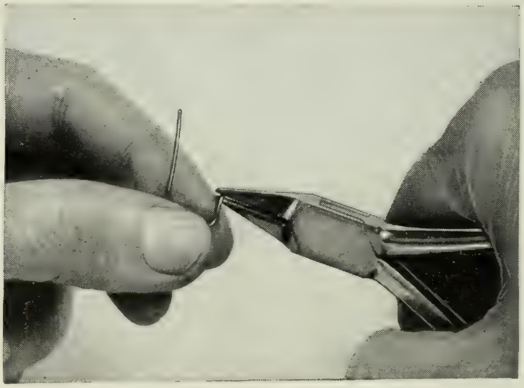


Fig. 268B. Grasp the wire with Peeso pliers and make the bend, holding with the fingers that portion which has been already bent, and no distortion will occur as would, if the wire were held with a second pair of pliers.

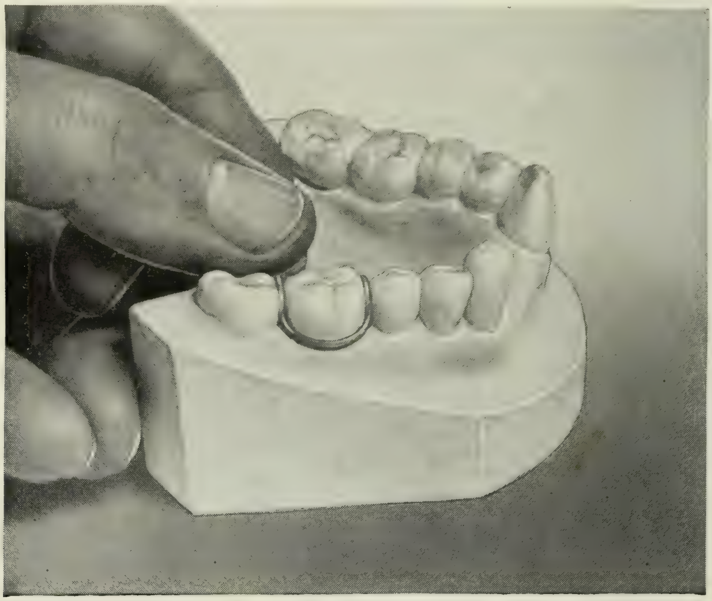


Fig. 269. Both occlusal bends made and tried on model.

not flat, and it also may be necessary to bend it mesially, or distally, as the occlusal embrasure is not at right angles with the buccal surface of the tooth. When this has been done, it should be tried back on the model to make sure that it fits without a spring. At all stages of bending, we should be careful to anneal this wire, especially if we are bending at a sharp angle. The annealing is best done by heating in a Bunsen burner to a cherry heat and plunging into cold water.

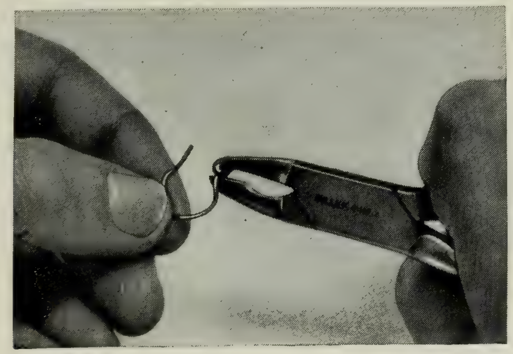


Fig. 270. Bending wire to fit concavity of the occlusal embrasures, with Nesbett pliers.

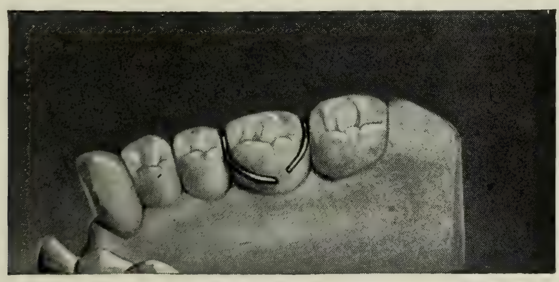


Fig. 271. Lingual side of the wire bent, but not too close to tooth, to allow for lingual plate.

In bending the concavity to fit the occlusal embrasure, the Nesbett pliers are best (Fig. 270) as they will bend without distorting the rest of the clasp. The convex side is placed downward, the pliers closed, and the small ball on the opposite beak of the pliers is forced down, just sufficiently to make it fit the interproximal embrasure. Never overbend. It is better to make two or three bends than it is to try to straighten the wire out and bend again, and at all times it is best to hold the pliers and with the fingers bend the free end of the wire, or press it into the rubber bench block. (Fig. 268B.)

The next step is to bend the wire to fit on the lingual surfaces of the teeth. (Fig. 271.) The wire at this location should never be bent tight to the tooth, but a little space should be left to allow room for the lingual plate upon which we do the soldering. The same procedure is followed in making this bend. The clasp is placed upon the model, grasped with the pliers at the point we want to bend, and the wire bent into position. These ends of the wire are bent just before assembling the pieces with sticky wax, and they are loosened just sufficiently to allow the piece to slip off the model without binding. This holds true of all clasp assembling. Clasps should be loosened at one point and this point should be noted, because when we come to adjust the clasp in the mouth, we should need to make only one bend to tighten the clasp. This gives us the minimum of back bending. Back bending is always detrimental to the life of a clasp.

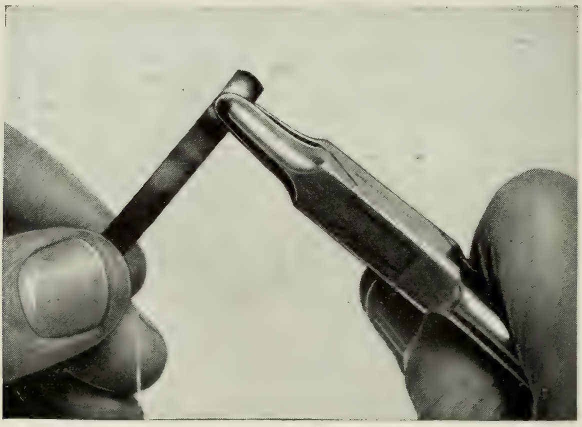


Fig. 272. Bending and contouring lingual plate, from a strip of 36 gauge gold, with Nesbett pliers.

Technique for the Lingual Plate.

Dr. Jackson in his orthodontia appliances uses bronz in making the lingual plate, but we are compelled to use gold. A piece of 36 gauge tin foil is taken, and burnished to fit the tooth on the lingual side, being very careful to outline the gingival margin. Dr. Jackson cuts his plaster model away, to allow it to go under the free margin of the gum. This is for young people who have a large flap of gum at the gingival margin, which would ultimately shrink back to the normal. Dr. Jackson does not have the assistance of tissue bearing parts, to hold the appliance in place, so must depend upon the teeth to do this work. Therefore, his technique must be modified in this respect, and in trimming our model we must not impinge upon the gingiva. Cover as much of the lingual surface of the tooth as possible, both up to the

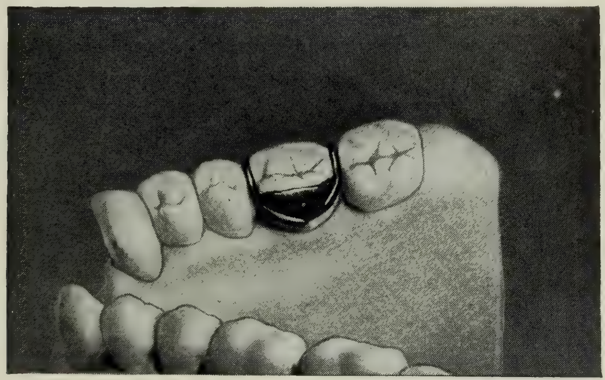


Fig. 273. Lingual plate trimmed to outline and wire placed ready for waxing.

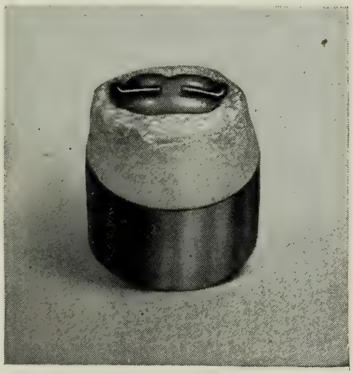


Fig. 274. Clasp invested, wax boiled out and investment trimmed. Never invest down in a hole; have the gold exposed to get direct flame of blowpipe.

interproximal embrasures and to the occlusal surface. In the maxillæ we must keep farther from the occlusal edge, than with mandibular teeth or we will interfere with the occlusion of the lower tooth.

The tin foil pattern is flattened out, marked on a piece of 36 gauge pure gold, which is cut out and then bent approximately with the Nesbett pliers (Fig. 272) to give it the proper contour, and then placed upon the model, and pressed to form with the thumb, or with a piece of unvulcanized rubber held between the gold and the thumb.

Assembling Crib Clasps.

We are now ready for assembling. The wire is loosened sufficiently to allow it to slip off the tooth, the lingual plate is placed into position, the wire placed over it and fastened with sticky wax. (Fig. 273.) The wire is held on the buccal side with one hand; the thumb of the other hand is wet, and while the wax is still soft, we press the thumb against the wax with considerable force. This will press the gold against the model, and we hold it until the wax hardens. After it is hard, we can dry the wax by means of a chip blower, or with compressed air, and more sticky wax is added to strengthen it. The clasp is carefully teased off the model and invested in any standard investment material. (Fig. 274).

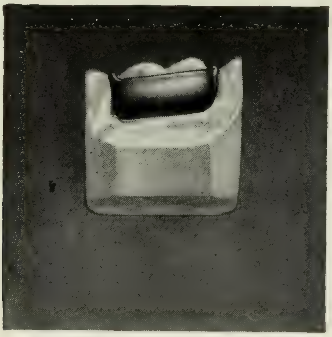


Fig. 275. Lingual side of Jackson Crib finished ready for impression to obtain relationship.

Management of Investment.

I prefer to invest within a small ring to prevent fractures of the investment material. These rings can be sawed from lengths of brass tubing of different diameters. When the investment has set, we should wash the sticky wax out with hot water, using a fine stream. A good apparatus for this purpose is a small copper coffee pot, with a piece of fine tubing soldered at the end of the spout. This gives a very fine stream and cleans up our investment nicely. The wire crib and lingual plates are then united by soldering. (Fig. 275.)

The function of the investment is to hold the parts together. There are certain definite rules for investing.

1. The investment mass should be made as small as possible, so that it can be heated quickly.

2. It should be sustained to prevent it from cracking, as with the tube I have mentioned; or small boxes made of wire, which is known as "cellar window wire," may be placed on the sides.

We will do better soldering if we have a large surface of gold exposed, to allow it to heat more readily when we turn the blowpipe flame upon it, and it should be so shaped that the flame can reach all parts of the exposed gold. No portion to be soldered should be down in a hole, or it will not become hot enough. Portions of the gold over which we do not want the solder to flow, should either be anti-fluxed, or covered with investment. I prefer anti-flux. If we want gold to flow into a space which is under the wire, or at a joint or crevice on the under side, we must cover this joint, or crevice, with sticky wax after the pieces are waxed up and lifted from the model, just before we invest.

Soldering Technique.

3. Investments should be dried out slowly at first, then more rapidly and we are ready to begin soldering. We should use either a liquid flux, made by dissolving borax and boracic acid in saturate solutions, taking equal parts, or a better flux can be made by mixing a stiff paste of a small quantity of white vaseline and calcined powdered borax. To obtain the paste, stir in as much calcined powdered borax into the vaseline as it will receive.

The essentials for soldering are: First; cleanliness. Second; contact. Third; heat. Fourth; flux. If the parts do not come together, we must push little pieces of gold between them to make contact. Solder is not strong in bulk. It is strong, however, when it is alloyed with the gold by melting it on, and the principle of the soldered joint is that we have a slightly lower alloy in the joint connecting both surfaces of metal.

The next requisite is heat, properly applied. Solder will flow towards the hottest point. Do not wave the blowpipe over the investment. Move it slowly around until you have the whole investment heated. Then apply it at the point where you want the solder to flow, and feed it in from a long strip of solder which has been coated with some flux. If the solder crinkles up, you know that you have not sufficient flux, or not sufficient heat.

It is a mistake to think that low karat solders are more easily manipulated. They will burn the gold quicker than the high karat solders. In my office we use Ney's casting gold No. B-2 for soldering our pieces. I prefer the Mellotte blowpipe, first using a large brush flame to heat the investment, then narrowing it down to a small pointed flame.

Do not use more solder than is necessary, as it is a waste of time to grind it off. If you have a large pair of soldering tweezers, you can pick up the investment while the solder is still soft, and move it around so that the solder will flow into the places where you want it. Even lightly jarring it on the soldering block, sometimes makes it go into place; but do not drop it. I have seen pieces dropped while the metal was still hot and the gold would fracture into a number of parts.

When the mass has cooled down to a cherry red, we can plunge it in water and remove the investment. The crib should be ground to shape but it is not necessary to polish it, for we want a roughened surface at the point where we are going to assemble it. If you do polish it, it should be polished very lightly, as polishing reduces the diameter of the wire. If it is carelessly done, we are liable to polish too much off at one point, and a fracture will occur later.

Cleansing Gold by Pickling.

I have said nothing as yet about pickling the parts. Small pieces are pickled in test tubes, large portions in a porcelain caserole. I prefer not to use the copper vessels for pickling, as the gold may come out copper plated. I have had one porcelain vessel for seven years, being careful not to allow moisture to be on the outside when we begin to heat. The ideal pickling vessel is fused quartz, but it is expensive.

I use a fifty per cent sulphuric solution. Hydrochloric acid works very well, but the fumes rust the instruments in the laboratory. Acid alum makes a good pickling solution, especially for the lower grade metals, and fifty per cent nitric acid is good for some golds. I believe that some men pickle too much. Some men pickle each time they anneal. This is not necessary, unless they are using fusible metal, or amalgam dies.

Keep mercury away from your gold, or you will always burn it. Always have a solution of sodium bicarbonate to dip the piece in after taking it from the acid. If by any chance you should get the pickling solution into your eye, wash it with sodium bicarbonate, or boric acid, or in an emergency, rush to your sterilizer and use some of the hot water out of it. All laboratories should be provided with goggles with safety glass for soldering, casting and pickling. I have seen hot metal and acids thrown into the eyes in a number of instances, due to explosions of investments, or dropping hot pieces into the acid. Also, when mixing acid and water, always pour the acid into the water, not the water into the acid, and there will be no sputtering and flying.

Further Technique for Jackson Cribs.

The Jackson Crib can be tried upon the tooth to see if it fits and adjustments may be made, but it never should be tightened to its full extent until the piece has been assembled and it is ready to be taken away by the patient. We would, however, see that it fits and does not interfere with the occlusion. If it is necessary to grind the teeth more, it should be done at this time. Never grind the approximal embrasure with anything but a round edge stone or a Burlew disk. V-shaped stones will cause separations, the wire being forced into the V. If the point of the opposing tooth touches the wire, it can be ground off with a smooth stone, or a sandpaper disk. Patients prefer the sandpaper disks. Often timid patients can be persuaded to allow you to grind their teeth if you tell them that you only want to polish off the rough points, and that these would have worn off if they had had the proper occlusion. I have never seen teeth decay at this point as the mastication of food keeps them clean.

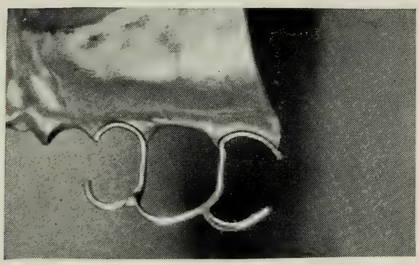


Fig. 276. Triple Jackson Crib used on an objurator held a replacement of full maxillæ removed by operation.

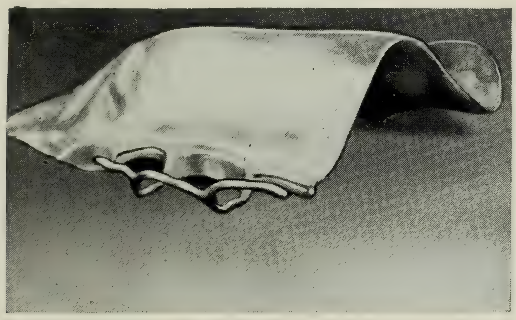


Fig. 277. Buccal view of same crib.

Modifications of Jackson Cribs. There are numerous varieties and modifications of the Jackson Crib; such as the double Jackson Crib including two teeth; the triple Jackson Crib, including three teeth; the embrasure clasp which is T-shaped, running down one embrasure and spreading out on either tooth and the Embrasure Clasp designed by Dr. George Crozat of New Orleans which is a modified Jackson Crib, having two extra fingers running into the embrasures.

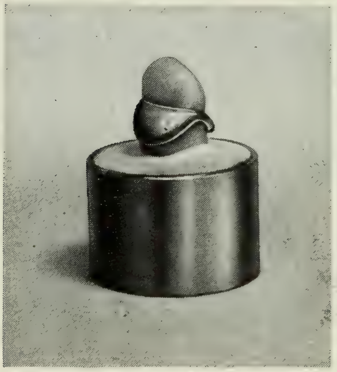


Fig. 278.

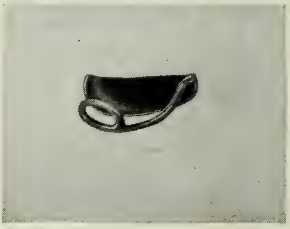


Fig. 279.

Fig. 278. Half Crib for cuspid tooth.

Fig. 279. Crib repaired by bending end around itself and soldering.

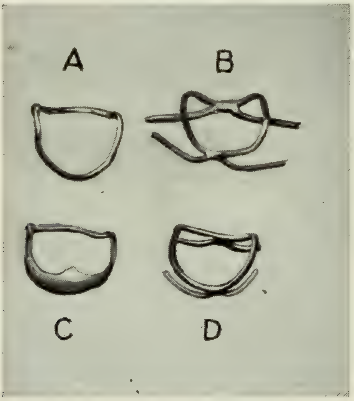


Fig. 280. A.—Full wire crib. B.—Full wire crib with embrasure clasp wing designed by Dr. Crozat of New Orleans. C.—Lingual plate and crib made by swaging process. D.—Wire crib with different forms of embrasure clasp wings reaching over to the buccal embrasure.

These will all be described later. The Jackson Crib clasp is an embrasure clasp, and it gets its hold by grasping into the embrasure. In tightening the Jackson Crib clasp we should use either the Nesbett pliers, or the Peeso pliers. With the Nesbett pliers, we take the concave side and place

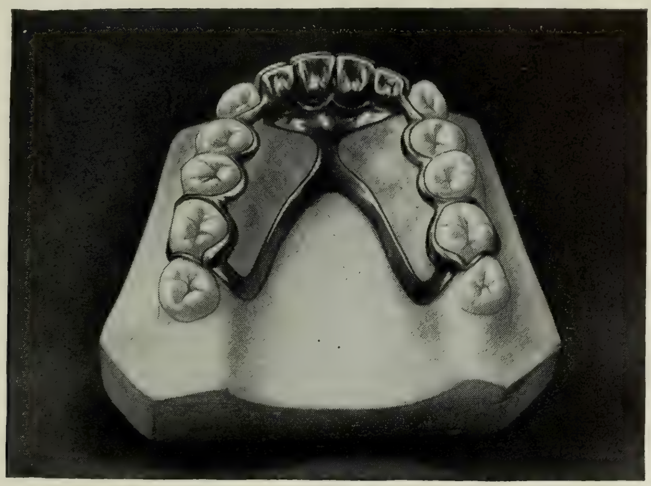


Fig. 281. Upper Class IV denture, designed by the author, held with Jackson Cribs This patient can bite an apple without displacing the denture.

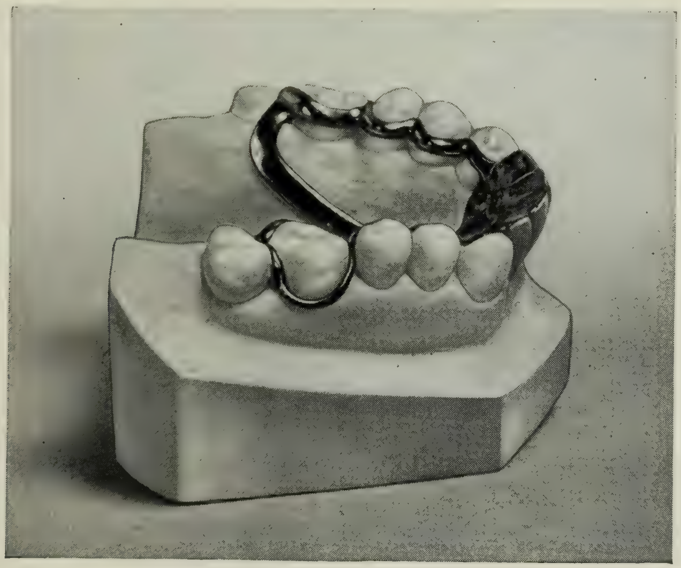


Fig. 282. Another view of same denture.

it at an angle of 45° between the upright wire and the buccal turn of the wire, bending it so that the wire presses against the tooth. Do not let the pliers slip off, or you will flatten the wire.

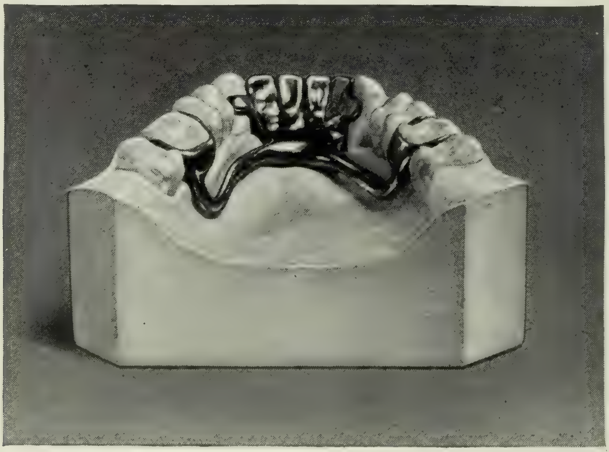


Fig. 283. Lower Class IV denture held by Jackson cribs. This patient can bite any article of food without displacing denture.

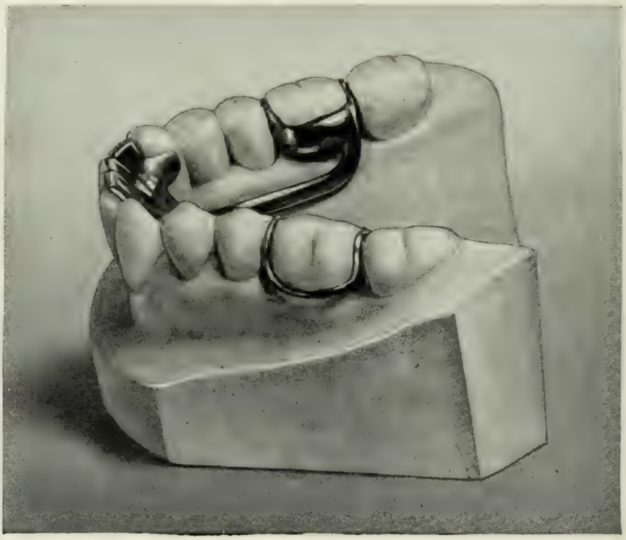


Fig. 284. Lingual view of same denture.

Jackson cribs are particularly suitable for surgical and cleft palate appliances, and they can be used on teeth which do not have contour to hold a clasp, by the simple expedient of drilling a small hole in the tooth on the buccal surface, and malleting in a pure gold filling, overfilling the cavity. The Jackson Cribs in these cases must be so designed as to spring over this super-contoured filling and it gives a good grip. In a number of surgical cases I have extended occlusal surface fillings down into the buccal and the lingual grooves, and so shaped my filling that they were over-contoured on these surfaces. This gives a very good grip to the clasp, especially the Jackson Crib.

The principal modifications of the Jackson Cribs are as follows:

The ordinary Jackson Crib, with wire extensions running over to the adjacent teeth. We make the ordinary crib and then bend little pieces of wire and solder as the orthodontist does, with the minimum quantity of solder, as shown in Figs. 276 and 277.

The half crib, which has the lingual plate, and half a crib on the buccal side. This can be made very nicely if we bend the free end backwards on itself, making a small loop and soldering the wire as shown in Fig. 278. This is a trick very often resorted to when the clasp breaks. The patient very often tells you that the clasp was not as comfortable with both cross pieces intact, as it was after it broke. Take this hint from him, and bend the free end back upon itself and solder. (Fig. 279.) This can be done without taking the rubber off the plate if we cover the plate with equal parts of wet asbestos and impression plaster, and solder the wire while the investment is still wet. Do not cover the wire with any investment, as it will heat up more quickly without it. This can readily be done with an ordinary blowpipe, but it is more quickly done with an oxy-hydrogen, or an aceteline blowpipe.

Next is a pure embrasure clasp. The wire runs over the occlusal surface, down the embrasure and a quarter of the way back on the buccal surface. An extra wire is soldered at the bend, running forward on the anterior tooth, about a quarter on the buccal surface. These make excellent clasps for the anterior part of the mouth, between the cuspid and the bicuspid, as they do not show much gold and have the same grasping effect as the half Jackson crib.

A very nice clasp was designed by Dr. Crozat, of New Orleans, which has a full wire Jackson Crib without any lingual plate, the wire being contoured around both the lingual and buccal surfaces of the teeth. Attachment to the denture may be made at any point on the lingual side. On the buccal side, two small fingers of wire are soldered to the clasp, their ends being free to bend into the embrasure.

In making this sort of a clasp, we do not carry the buccal side to the gingival margin, as these small fingers take their place. The clasps can be swaged, by a technique outlined by Mr. Roth. (See Chapter XV.) When we do swage such a clasp, after having obtained our die, we bend pattern wire to the shape of the clasp and pour counter-dies while this pattern wire is in place. This gives us a groove in the counter-die to hold the wire when we are swaging. Jackson Crib appliances form excellent attachments for Class IV plates. Figs. 281 and 282 show such attachments on an upper denture. Figs. 283 and 284 show similar attachments on a lower. They have in themselves a principle of indirect retention. If the plate shows a tendency to rise in the front in the lower, or fall in the upper, by bending the wire which goes across the distal occlusal embrasure, this tendency to rise, or fall, will be overcome. The bending should be done in a direction towards the occlusal surface of the teeth.

CHAPTER XX

Flat Plate and Matrix Clasps

Flat plate clasps are useful in retaining dentures, especially where there are few teeth left in the mouth. They are particularly useful where the attachment is made to a crown. On the natural teeth they are very liable to cause decay. The only other objection is that they place more strain upon the tooth than the Gillett clasp, or the round wire clasp, and wherever possible, they should be used in conjunction with stress breakers.

We can divide these clasps into two classes; the ordinary, or encircling clasp, and the mesiodistal clasp. The tooth to be clasped should be carefully outlined with the clasp surveyor, and the clasp so designed that one-half of the width will be above the height of contour, and one-half below, as shown in Fig. 285.

As they are used in cases where we want to obtain the maximum of holding force, they must be well contoured. It is here that they present a weakness, as they are liable to produce decay on natural teeth, and it is the writer's belief, that the matrix clasp is far superior because with the pure gold lining of the matrix clasp he has noted less subsequent decay.

After outlining the clasp, a pattern should be made. The writer uses Ash's metal No. 7 and rolls it to the same thickness as the clasp metal. These clasps (Fig. 286) are made of 24 or 25 gauge metal; therefore, the pattern should be of the same gauge. It is not advisable to use thin tinfoil, to make a pattern, because when we straighten it out, we will find it distorted and it will be difficult to shape the clasp if we start with a distorted pattern, especially on the buccal end. The writer allows over one millimeter leeway all around, on this end, because in bending the clasp, it very often bends up and down, and does not cover the clasp outline exactly. (Fig. 287.)

Dr. Kingsley, who developed the flat plate clasp to a great degree, used stiff writing paper for his pattern. His method is described later in this chapter.

In cutting the gold from the pattern, care should be taken to lay the pattern lengthwise of the direction of the rolling. This gives us the strongest clasp. In rolling gold, the fibers of the gold interlock, and these fibers should not run up and down, but in the long direction of the clasp. Also, in cutting the clasp out of the gold, we should not cut the plate to the corner with the scissors, as we are liable to leave a small nick and when we cut the next clasp, this nick might be unnoticed and start a fracture in the clasp. Rather we should stop just short of the corner and break the gold out. (Fig. 288.)

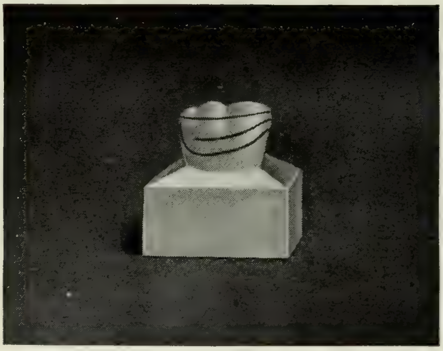


Fig. 285. Showing outline of flat plate clasp, one-half above the height of contour and one-half below.

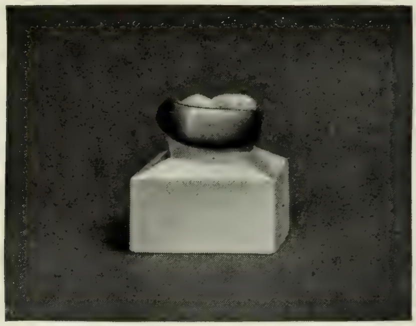


Fig. 286. Pattern for clasp made with Ash and Son's No. 7 metal rolled to the same gauge as the clasp.

In bending the clasp, we should begin our bending on the lingual side, working towards the buccal side. The clasp should be contoured in an up and down direction, with a pair of Nesbett pliers (Fig 289). The Nesbett pliers are ground so that the surface opposite the ball-shaped beak is made egg-shaped. We can do most of the bending with these pliers.

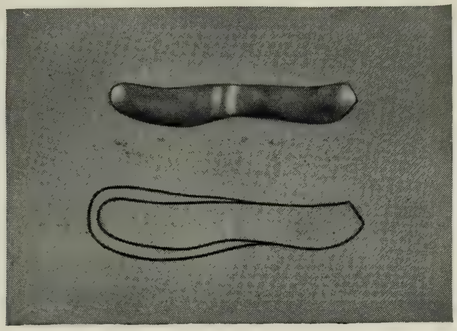


Fig. 287. Pattern straightened out. Outline marked so as to allow a little leeway on the buccal end of the clasp which allows for any distortion.

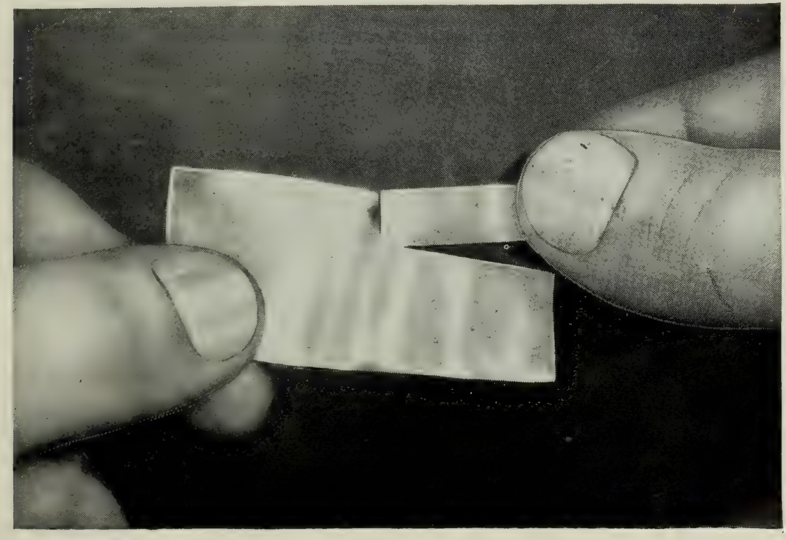


Fig. 288. When cutting the pattern from the plate, never cut to the corner. Stop just short and break out the piece of metal. Always mark the pattern the long way of the rolled gold.

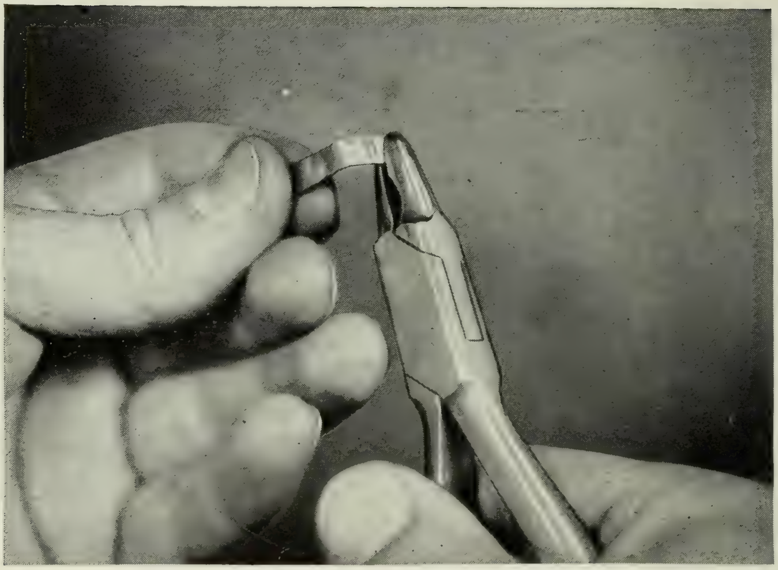


Fig. 289. Nesbett pliers should be used in contouring the clasp in an up and down direction, the ball end of the pliers on the inside of the clasp.

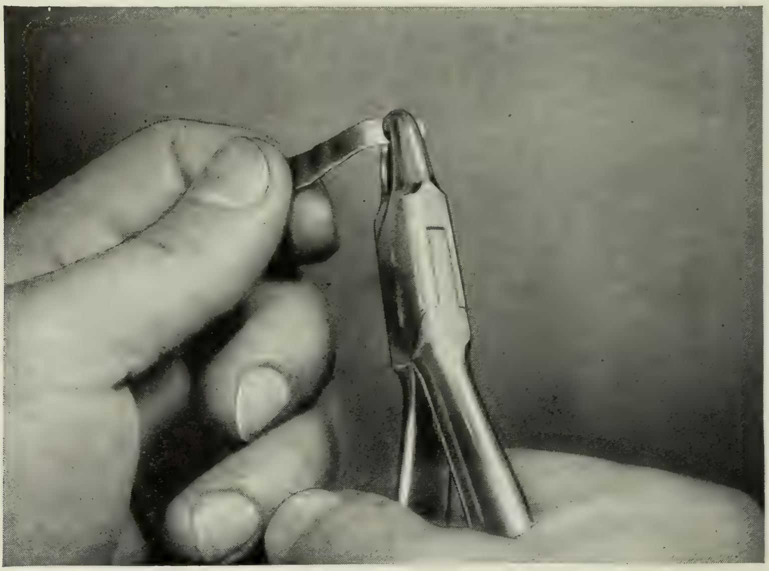


Fig. 290. Contouring the buccal groove; use the ball end of the pliers on the outside and the egg-shaped socket on the inside.

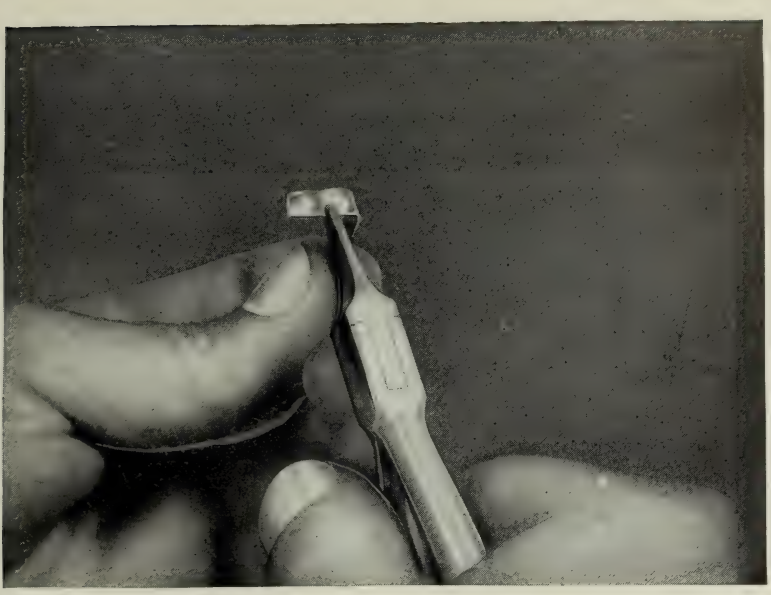


Fig. 291. Sharpening the groove with Peeso pliers.

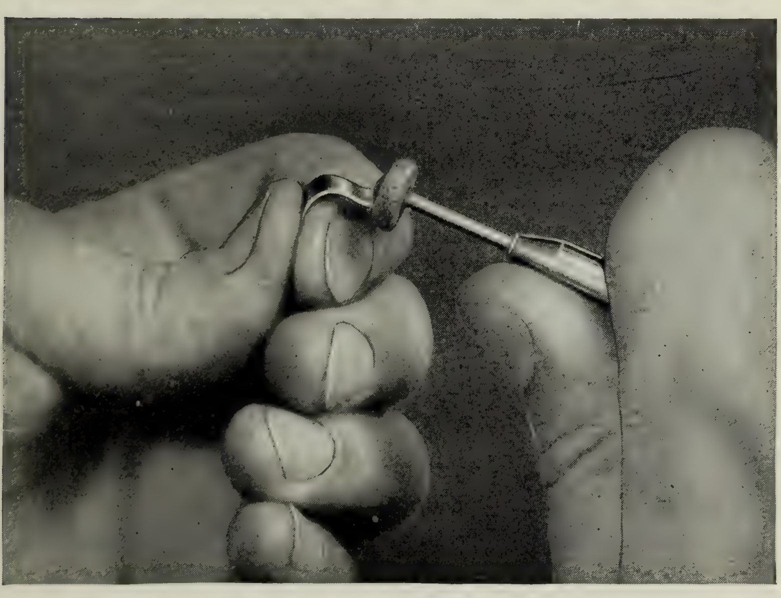


Fig. 292. The clasp should be finished with a stone in the engine so that it presents no sharp edges to the cheek.

Attention can be given to the buccal groove by reversing the pliers, and forcing them in at this point. (Fig. 290.) If the groove is not sharp enough, a pair of Peeso pliers, (Fig. 291) will assist in making it sharper. Never contour the clasp rounding on the mesial surface of the tooth. It should be perfectly straight here, so that it can be taken in and out, without forcing the tooth out of position.

When we come to the buccal side, we again use the Nesbett pliers, and if there is a little surplus over the outline, it can be ground off with a stone in the engine. The small amount of gold that we cut off is not lost, as the saving in time more than offsets the value of the gold saved if we cut to the exact outline.

After the clasp has been shaped, the edges should be rounded so that they present no sharpness to the cheek. (Fig. 292.) At no time in the bending should we neglect to anneal the gold. After annealing, it should be plunged in cold water to soften it. The temper can be brought back again by allowing it to cool slowly after soldering.

Dr. Kingsley's Plate Clasp Method.

Dr. Norman W. Kingsley, one of the premier prosthodontists of his time, argued, that in order to obtain an adequate pattern for a clasp, it is necessary to use material for the pattern that will be rigid like the clasp metal, and not anything pliable, such as tin. Therefore he used a fairly stiff writing paper. A strip is cut, much too wide, and also too long, and bent around the surface of the tooth which the clasp is to encircle, the two ends going buccally and lingually, as they may. If the student will try this, he will be surprised to note just where these free ends do go. With a fairly dull pencil (a sharp lead would cut the paper) the pencil point is first carried along the gum margin, and the pattern is cut to this line. Next the upper, or occlusal margin of the clasp is marked with the pencil, and also the points at which the two ends are to be cut off. The paper pattern is then cut to the line. Later it is laid on the sheet of clasp gold, and a line scratched around it with a sharp instrument.

To form the gold into a clasp, the gold is first bent throughout its length, with clasp benders, as previously described, but Dr. Kingsley fashioned his clasp to fit into the lingual groove commonly found on molars, and especially upper molars, in a somewhat unique manner. Tentatively laying his clasp along the lingual surface of the tooth on the model, he made a scratch mark opposite the lingual groove. He then laid his gold on a block of lead (such as a lead counter die) and using a chisel shaped instrument, with a sharp blow with a mallet, produced an indentation along the upper margin of his clasp. Dr. Kingsley used ten-penny nails, sharpened to resemble chisels, but any chisel-pointed instrument will serve, only it must be fairly wide, for the following reason.

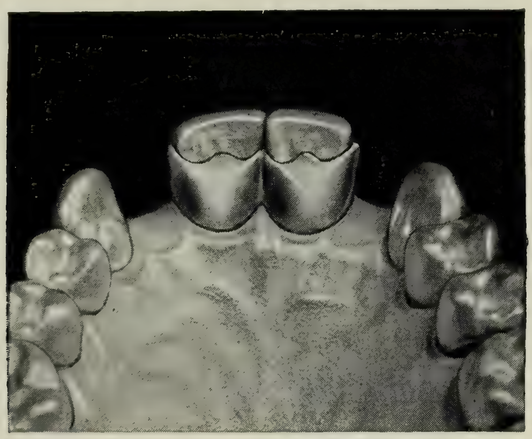


Fig. 293. Lingual view of a mesiodistal clasp for two central incisors.

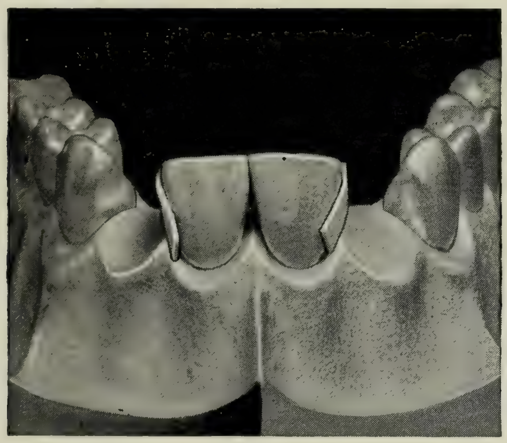


Fig. 294. Labial view of a mesiodistal clasp for two central incisors. The ends are allowed to be long until fitted into the mouth, so as to give a hold in the investment when soldering.

Only about half the width of the chisel blade should touch the clasp gold, and, moreover, the tool should be slanted slightly away from the clasp metal. When struck with the hammer, the chisel produces a dent which is deeper at the upper margin, disappearing by degrees as the dent mark passes downward on the clasp. Often such a dent will be too deep, but is easily lessened with flat pliers when bending the clasp to fit the tooth. The fitting of this clasp to the tooth contours is the same as already described.

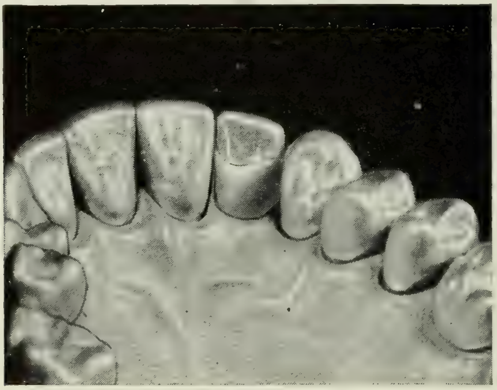


Fig. 295. Lingual view of a mesiodistal clasp, the wings running between the lateral incisor and the central incisor on one side, and the lateral incisor and the cuspid on the other.

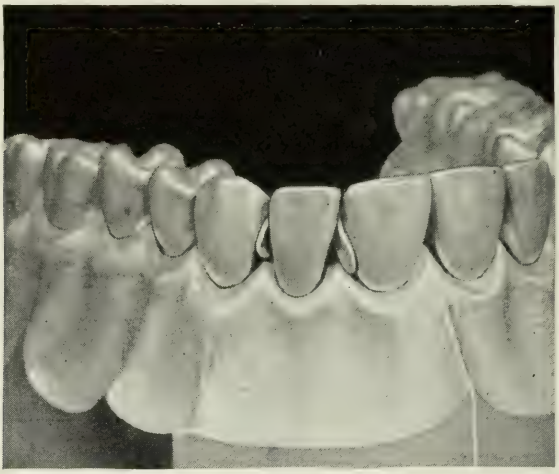


Fig. 296. Labial view; the wings of the clasps press against the central incisor on one side and the cuspid on the other. In this way, no strain is placed upon the lateral incisor.

Another point noted by Dr. Kingsley is worth recording. Not in-frequently maxillary molars are short, and so conical that it is very difficult to fashion a clasp that will grip the tooth with any retentive energy. Dr. Kingsley observed that nearly all upper molars have a decided depression, just below the lingual margin, along the mesial surface. Hence, he carved this margin away on his model, before making the paper pattern, and the pattern was shaped so as to form a distinct lip, which could be bent and made to pass under the free margin of the gum slightly, at the point indicated. Such a clasp, made on a carved model, must necessarily be carried to the mouth for final accurate adjustment, and in attaching the clasp to the plate, the clasp should be on the natural tooth in its most efficient position, the plate put into place, and an impression of the two taken and assembled on a model made of investment material, to facilitate soldering.

Mesiodistal Clasp. Mesiodistal clasps are used in the anterior parts of the mouth where it is undesirable to show gold, or where the teeth are out of alignment. The wings of these clasps are so designed as to be parallel with one another. I believe that Dr. Roach of Chicago originated the mesiodistal clasp. He made it by the casting process and paralleled the sides of the tooth to be clasped, with a carborundum disk. I prefer not to do this, as sometimes we may cut through the enamel and invite decay. It is much easier to separate the teeth by means of a separating silk tied in for a few days before we take the impression, and in many instances we do not need to do this because there are spaces between the teeth.

The mesiodistal clasp has many variations. In the anterior part of the mouth, where two central incisors are in place and the lateral incisors are absent, we can make the clasp grip the distal side of each central incisor (Figs. 293 and 294), or if we pass between a central incisor and a lateral incisor or cuspid, it is not advisable to make it grip the lateral incisor. In such a case we can make the wings of the clasp press against the central incisor and the cuspid (Figs. 295 and 296), on either side of the lateral incisor. The ends can be so designed that they resemble small gold fillings on the approximal surfaces of the teeth, and if a little finger is left to press against the basilar ridges, (Fig. 297), that will help to hold the back edge of the plate in position. I shape these clasps with a Nesbett pliers, and leave the wings longer than I intend to have them, so as to obtain a good hold in the investment when we are soldering, or vulcanizing.

When the plate is ready for the teeth, the clasps are tried in the mouth to see if they hold and are adjusted to their proper tightness. The finger which runs up at the back of the basilar ridge is bent against the enamel, and this, by indirect retention forces the back edge of the plate against the palate. (See Fig. 297.) It is then taken out and with a light investment, this wing is covered with solder which prevents it from bending back. These mesiodistal clasps often prove very satisfactory. They can also be used on bicuspids where the bicuspids stand alone. I do not think it advisable to use occlusal lugs, but the clasp should fit so tightly that no food can pack between the clasp and the tooth. It is seldom necessary to use them on molars except in Class II cases, where the tooth which is clasped, is either a porcelain crown, or has a filling in the mesial, or distal surface and can be separated with a separating disk, enough to allow us to go between the teeth with the clasp metal.

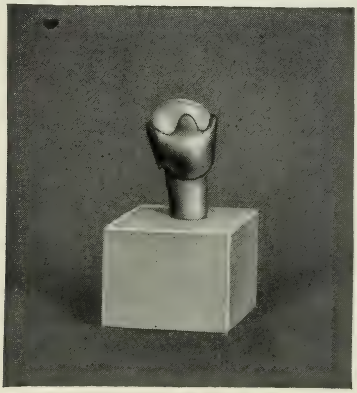


Fig. 297. Wherever it is possible, allow a little finger of metal to rest against the basilar ridge. After the clasp is soldered to the plate, this finger is pressed against the enamel and it tightens the plate at the back edge. Later it is soldered to stiffen it so that it will not bend back.

In separating these teeth with the separating disk, it is always advisable to use a safe-sided disk, so that the safe side will prevent marring the enamel of the adjoining tooth. Here it is quite necessary for us to use an occlusal lug, to prevent the clasp from settling and injuring the interproximal spaces.

Matrix Clasps. I have used the matrix clasp for over twenty years, and I have recently seen some that have given good service for over eleven years. I have a Class III surgical case, where three such clasps are holding a restoration over a graft on the mandible, which supplies everything anterior to the third molar on one side, and the third molar on the opposite side. These were placed in position five years ago, and last summer I had the pleasure of presenting this patient before the International Dental Congress in Philadelphia. I took him there as an answer to the argument of the "one-piece casting" men, and there was no response from them. He had discarded his original denture, due to the fact that the ordinary type of cast clasp had ruined one of his teeth, so that it was necessary to extract it, and the others were practically denuded of enamel, requiring large buccal fillings. There has been no further erosion and the sensitiveness has left the teeth.

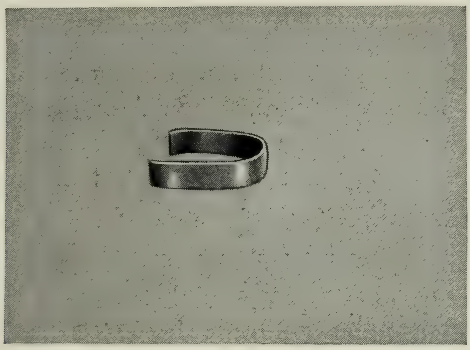


Fig. 298. Piece of flat plate clasp metal contoured to fit a tooth.

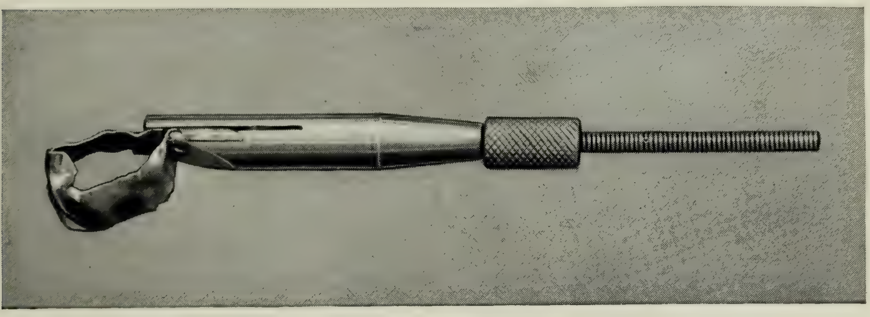


Fig. 299. Wagner matrix holder, with pure gold in place of the matrix ribbon.

I can see no reason why we should cast clasps, and many reasons why we should not, unless these castings are to be placed upon gold or porcelain crowns where they will not cause erosions, or where we can use stress breakers with them, so that they will not drag the teeth out of position.

The time needed for making a cast clasp is from three to four times that required for a matrix clasp. I have demonstrated this many times. With the matrix clasp, you never fail to produce one that fits, whereas I have seen numerous cast clasps that had failed in the casting and had to be made over.

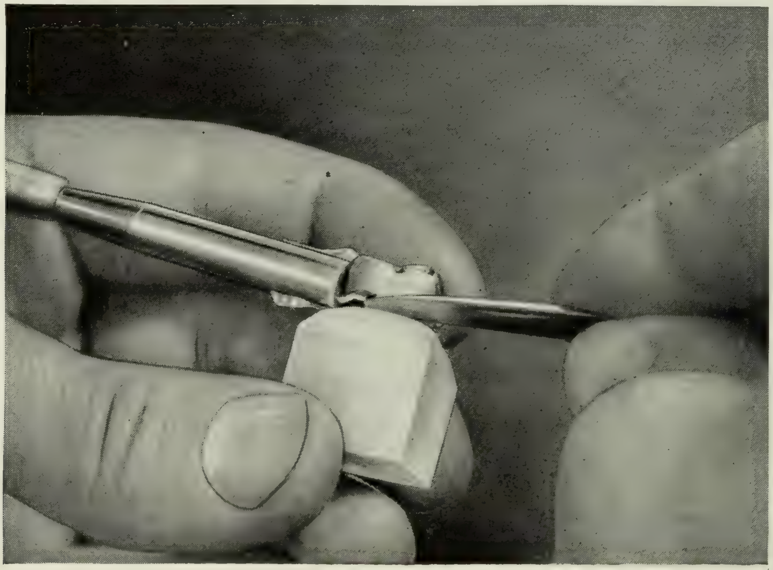


Fig. 300. Pure gold burnished to the model; a knife blade is used to turn up the lower edge, which assists us in removing it from the model, and later acts as a shelf to lay solder on.

The method herewith described was shown to me about twenty years ago by Dr. Straussberg, of Newark. The model from which the clasp is made, can be either of artificial stone, or of amalgam. I prefer the artificial stone, as there is not the danger of alloying the gold, as when working on amalgam dies. Separate impressions of the teeth to be clasped can be taken, or a clasp can be made immediately on the stone model from which we are constructing our work. The clasp is outlined and a piece of 25-gauge clasp metal plate is fitted to the contour. (Fig. 298.) This need not fit quite as accurately as a flat plate clasp. The adjoining tooth, distally, is sawed away, and an ordinary amalgam matrix holder is used. In place of the matrix band, a piece of pure gold is substituted. (Fig. 299.) This pure gold must be wide enough to extend at least 2 millimeters beyond the outline of the clasp design. I also allow it to cover the lug seat. I use a Wagner matrix holder.

The matrix holder tightens the pure gold around the tooth, and we burnish it with a flat instrument, to fit. As we proceed with the burnishing, we tighten the matrix holder, and when a perfect fit is obtained, (Fig. 300), including the lug seat, we place the flat plate clasp which has already been contoured, in its proper position and fasten it to the gold matrix with sticky wax, a minimum quantity of wax being used. We must also be careful to see that the lug seat is filled with wax. Then we turn up the lower edge of the gold to form a little shelf. This is

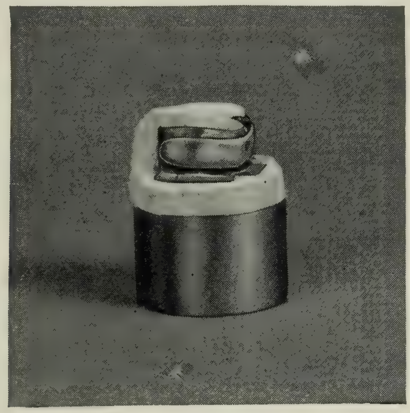


Fig. 301. Clasp invested. Note the shelf upon which to lay the solder.

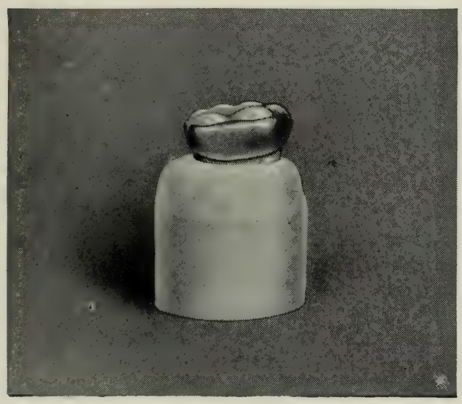


Fig. 302. Finished clasp.

of the utmost importance, (Fig. 300), because it is on this shelf that the solder must rest, when we do the soldering.

The matrix holder is loosened, and with a knife blade placed under the shelf, we raise the clasp from the tooth. Do not attempt to take the clasp from the tooth by grasping the plate with the fingers, because we will find that the gold fits the model so closely that the two parts of the clasp will separate even though fastened with the sticky wax.

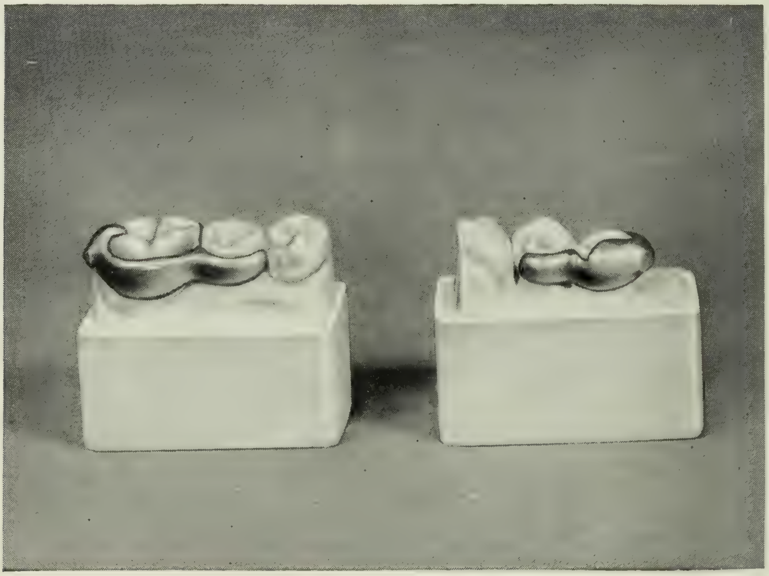


Fig. 303. Double matrix clasps, for molar and bicuspid, and for two bicuspids. The object of these is to gain extra support where the tooth clasped is not held very tightly in its socket.

After we have taken it from the tooth, and the surplus gold which was held in the matrix holder is removed, we are ready to invest.

Investing Matrix Clasp.

The investing of the clasp is important in that we must not have a large investment. I would advise the student to buy some brass tubing, about 1/4 inches in diameter and saw them off in lengths of about 1/2 inch. Fill such a tube with investment material and then place some on the inside of the clasp; be sure there are no bubbles or the matrix will burn. The clasp is then placed upon the investment in the ring and the edges of the gold are covered with investment material. (Fig. 301.)

Soldering Matrix Clasps.

When it has hardened, the wax is washed out with a thin stream of hot water, and then fluxed. It is then dried over the gas flame until all moisture is driven off. These clasps are as flexible as a plate clasp provided we solder with 22 karat Ney's solder.

The solder is cut into small pieces, thoroughly fluxed and placed upon the shelf of gold. It is then heated with the brush flame of the blowpipe, holding the flame immediately above the clasp, so that it is all heated at the same time. When it has reached a red heat, the flame is narrowed down and played upon the upper edge of the clasp metal. The solder will melt and flow between the plate and the pure gold, thoroughly uniting the two.

After soldering, the clasp is lifted from the investment and the surplus gold is trimmed away with stones, and finished. (Fig. 302.)

During the process of soldering, it is well to strengthen the lug seat with a piece of half round clasp wire. The round surface of the wire should be fitted into the lug seat, the flat side upward. This little piece of wire should be fitted before the clasp gets hot, as we cannot stop the soldering to fit it into position.

Many men ask me why I do not use platinum to line clasps with. I think it is a decided disadvantage to do so, as it is much harder to burnish platinum and it burns very much more easily than gold, if we use a low karat solder.

These matrix clasps can be made and placed in the mouth when we take our final impression. They are the only clasps that I have ever used that give a really good grip upon the porcelain tooth. I have one in my demonstration kit, which I believe has been removed from the porcelain crown over a thousand times and in many instances has been placed backwards by some careless dentist. It has not broken and seems to have the same flexibility as when I began using it for demonstration purposes in 1906.

The matrix clasp can be used where we desire to make a double clasp, where we wish to run an extension finger on to another tooth to gain a little extra support. In this instance, it is best to make the larger clasp first and wax the extension finger to it and solder. The two shown in Fig. 303 were made in this manner. Where we are making a clasp for an anterior tooth such as a central or lateral incisor or cuspid, it is very much more comfortable for the tongue to line the lingual side of the clasp with pure gold and make a half matrix clasp. As I mentioned in the chapter on Jackson Crib Clasps, the Jackson Crib is really only a half matrix clasp, with the crib wire on the buccal side of it instead of the flat plate.

Many combinations of matrix clasps can be made. Some with the matrix on the lingual side with a round wire on the buccal or labial side. Narrow ones can be made by using half round wire. These are particularly successful on short teeth, such as third molars, or conical shaped bicuspids. These in many instances must be assisted in their grip upon the tooth, by drilling a small hole in the buccal pit, overfilling it with gold, and making a small button on which the clasp grips.

CHAPTER XXI

Attachments for Movable Clasps

There are numerous attachments external to the teeth, which allow the clasp itself to move. The author has had considerable success in the use of five of these, three to be attached to the clasps and two to be attached to the dentures. Those used on the clasps have been the Kayle and two forms of the Dresch attachments. Those used on the denture, are really miniature clasps grasping a ball, or a flat button, attached to inlays, and are the Roach Flat attachments and the Roach Ball attachments. These clasps are really "stress breakers," but function as clasps, and have been shown in Figs. 191 and 192. The technique for using them was not there described but will be in this chapter.

The first movable clasp which we find mentioned in the literature was made by Dr. Evans in Paris, in 1865, and is owned by the Evans Institute Museum, of Philadelphia. It was very complicated, but it evidences the fact that Evans recognized the necessity for movement in certain types of dentures, to prevent the attached tooth from becoming loosened, due to too much stress of mastication, or using too rigid a clasp. It was illustrated in *Items of Interest*, in March, 1916, and is shown here in Fig. 304 as a matter of historical interest.

Dr. Essig of Philadelphia has developed a number of types of movable clasps, and I remember seeing some of them as early as 1903. They were all constructed for individual cases, were made by hand, and well served the purposes for which they were intended. None except the one made with the ball and socket joint (Fig. 305) had a movement in more than one direction. They have been superceded by the manufactured types.

The Essig Types of Movable Clasps

Dr. Essig has developed some very useful types of movable clasps, two of which are quite simple in their construction. One is the ball and socket type shown in Fig. 305. This is made by taking a piece of 17 gauge, clasp wire, and melting the end of it in a blow pipe, until it forms a ball. It should then be put in the lathe in a small chuck, and with a file made perfectly smooth and round. This serves as the ball end of the attachment. Then we take a piece of 25 gauge, clasp metal, and place it on a lead counter die, and with a ball ended instrument we hammer a depression into the clasp metal. The hole is then drilled through the center of the depression, and made sufficiently large to allow movement of the ball, when the wire which holds it is placed through this hole. When this has been done, we cut the socket with a pair of shears and file the edges flat, so that it will fit tight against the clasp. The clasp having been prepared previously, we are ready to assemble and attach to the saddle. These are more practical in cases where we have gold saddles, but they can be used also in conjunction with vulcanite by soldering a wing on the end of the wire of the ball and socket joint. If we are using them in connection with a gold saddle, it is best to place the clasp on the tooth, and the saddle in its position, and then take a relationship im-

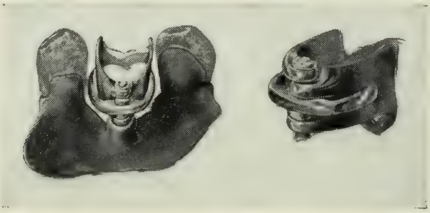


Fig. 304. The first example of a movable clasp, that has been found mentioned in dental literature. The specimen is in the Evans Institute Dental Museum, Philadelphia, Penna.

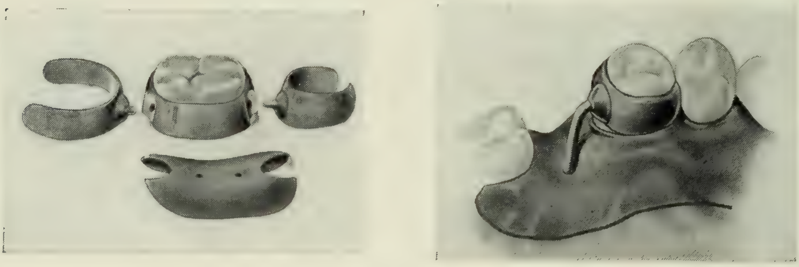


Fig. 305. Movable clasp with ball and socket joint, devised by Dr. Norman Essig.

pression, either in plaster, or in compound, to be used for making a cast for assembling. These casts are best poured in investment material of the hard type; then we are certain that we have the relationship correct. When we come to the assembling of the parts of this type of clasp, we must fill the socket with an anti-flux to prevent the solder from soldering the ball tight, which would defeat the purpose of the clasp.

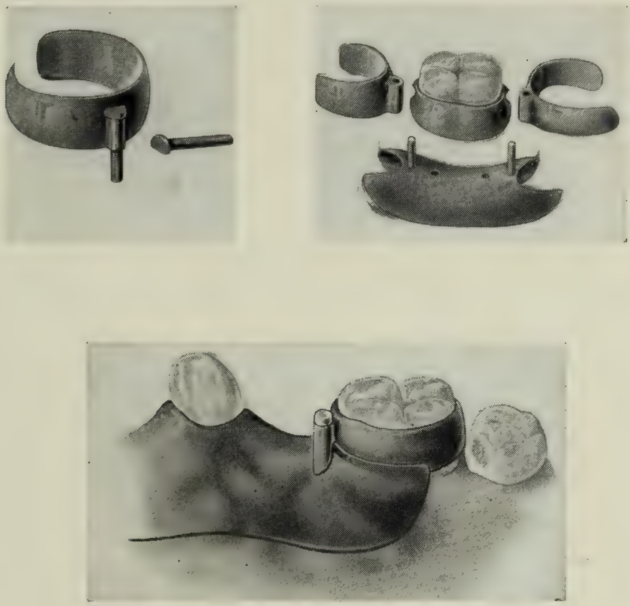


Fig. 306. Movable clasp, with joint made of an upright pin with head, engaging an upright tube. Devised by Dr. Norman Essig.

The second type of clasp that Dr. Essig uses, is one which only has a side to side movement (Fig. 306) and is constructed by using a piece of number 17 round wire with a head on it, which can be made in the same manner as the ball on the last mentioned attachment. We then select a tube of clasp metal which fits this wire, and after having obtained our relationship impression, we solder the tube to the clasp. The hole in the tube should be filled with an anti-flux to prevent filling with solder. The clasp is placed upon the working cast and a hole is drilled through the saddle, and counter sunk on the under side. The clasp with the tube on it, and the wire with the head on it, are assembled on the cast and investing material is poured over the clasp, and the saddle is reversed and soldered from the underside. The solder fills up the countersink and makes a very strong union. When we drill the hole through the saddle it is a good idea to drill a little way into the model, and when in assembling the parts we cut the wire so that it extends into the hole in the model, this will give us a slight projection on the tissue side of the saddle, which can be ground smooth after we complete the soldering operation. Dr. Essig uses these attachments in connection with the flat plate clasp and after the clasp is finished he cuts the center of the flat plate out with burs and stones making it an open work type of clasp. (Fig. 307.) He claims that he prevents erosion of the enamel by doing this. These attachments can be used with a round wire and the double round wire clasps, but when we are using the ball and socket type a piece of flat metal must be soldered to the wire to close up the back of the ball and socket. With the tube and pin type this is not necessary as the tube can be soldered directly to the round wire.

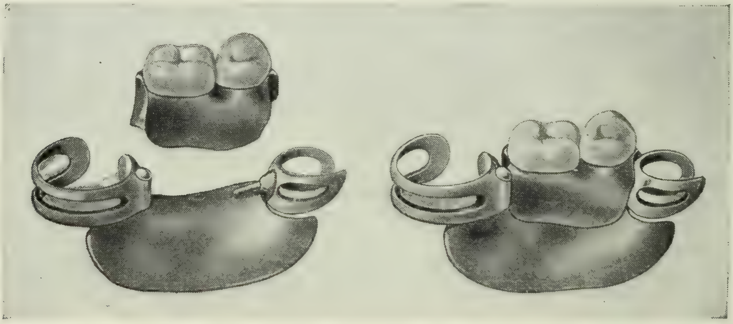


Fig. 307. Movable clasps devised by Dr. Norman Essig. The clasps are of flat metal, subsequently cut out to cause them to cover less tooth surface. The open cut likewise renders the clasp more flexible.

There are a number of movable clasp attachments now manufactured, and I see no reason why any well constructed one should not be used, provided it has the movements necessary for the case in hand. Stress breakers are very useful in surgical cases, where it is not possible to get firm foundation for the saddles, but I believe that the principle of stress breaking has been over emphasized for cases which have firm ridges and firmly placed teeth, in alignment, and I do not believe that it is often necessary to have more movement than is provided by the ordinary round wire, spring clasp, of the Gillett type. If there is too much movement the ridges become sore, and if there is not enough when the denture presses against the stop of the attachment we are placing just the same stresses upon the clasped teeth, as though we had originally used an ordinary clasp.

With a Class III denture, or one of its modifications, we have a case which is very nearly a true bridge, and we do not want much movement; only enough to allow the clasp to seat itself, if the tooth to which it is attached is out of parallel with the others that are clasped. In such cases I use the Kayle attachment. This attachment being limited in its motion and being very small in size makes a good attachment for this type of work. In the Class I type, where the ridges are very soft and yielding (more especially the surgical cases) we need something which has more movement, but we endeavor to prevent excessive strain being placed upon the attached teeth, and in these cases I use the Dresch attachment. It has all of the movements of the Kayle but the hinge movement is greater. I have been using the original Dresch attachment (Fig. 308 A) for some time and have found it very satisfactory. Recently Mr. Dresch has developed another type (Fig. 308 B), which is very much more compact and much easier to use. He has a third style but I have not used it, and I believe that the one illustrated in Fig. 308 B is his latest development. Mr. Dresch has given a great deal of study to this subject and has written numerous articles for dental societies and he has formulated certain requirements that an attachment must have to be practical. To quote Mr. Dresch, he says: "First the attachment must have unlimited movement. Second the attachment must allow for lateral movement. Third the attachment must have hinge movement. Fourth the attachment must be adjusted to permit settling without looseness, and still prevent stresses from being transmitted to the abutments. Fifth the attachment must be automatically self adjusting to keep the denture tight against the normal tissues without repeated adjustment by the dentist."

I believe that the above is very good, but must be modified to some extent. Absolutely unlimited movement is not wanted in certain types of dentures, and it is for this reason that, under certain conditions, I use the Kayle attachment. That is when we are supplying a few teeth, with clasps both anterior and posterior, one of the clasped teeth being out of alignment; then the function of the attachment should be only to allow us to get the piece into position without straining the natural teeth.

Limited movement attachments are useful in Class II cases at the end of the bar running across the mouth, which is used to stabilize the denture although the well constructed Jackson crib answers the same purpose, and is much easier to repair. I have had to make very few repairs of either the Dresch or the Kayle type. Of course I do not use them as extensively as some men do, hence my percentage of repairs should be low.

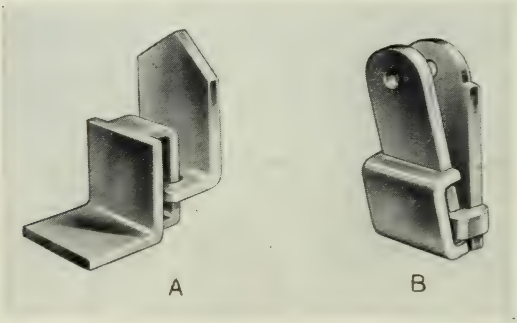


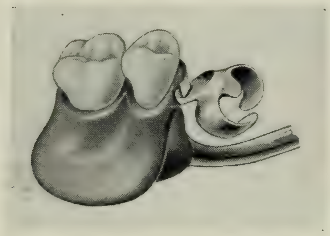
Fig. 308. Two types of Dresch attachments. A. Original type. B. Later type. This latter is more compact than the first.

Dresch Type of Attachment

The Dresch attachment comes already constructed, and the movements are well calculated. This attachment has two parts, the one which is soldered to the clasp (Fig. 308 A) is the one which has the "V" shape point upon it. When we obtain this from the supply house we find a rod of iron, which is placed in the slot in the two portions of the attachment. This is to keep it in its proper position while we are soldering, and should be left in place until the piece is completely soldered, when it can be removed with a pair of pliers. We place our saddle upon the cast with the clasp in position, and adjust the attachment to the proper relationship. The two are fastened together with sticky wax, lifted off the cast and invested. I would advise no one to attempt to solder these without applying anti-flux over the joint.

Sometimes it is necessary to solder a wing extension on the second portion of the attachment to allow it to get a hold in the rubber if we are using it in a rubber denture, or if we are soldering one to the bar in the type of denture shown in Fig. 309. After we have united the parts by soldering, the excess solder is cut down with stone, and the "V" shape point smoothed down, as shown in the completed case (Fig. 309).

The new type of attachment (Fig. 308 B) is a little more compact, and when it comes from the supply house it has a little rivet which holds the parts together. This is handled in exactly the same manner as the other attachment, except that the rivet is allowed to remain until the soldering has been completed and the excess ground off. We must be careful not to allow the rivet to come in contact with the clasp, or it will be impossible to separate it, because the solder will hold the parts together. It should project above the clasp and be ground off when the work is finished. In this clasp also use an anti-flux, or we may have the trouble that the two pieces of the attachment may be soldered together.



No. 309. Posterior section of a lingual bar denture, for a Class I case, showing clasp hinged to the plate with a Dresch attachment.

Anti-fluxes. As an anti-flux I use ordinary whiting mixed with water, or rouge mixed with alcohol. When using the attachments with vulcanite the manufacturer advises us to use plaster to prevent the vulcanite from getting between the parts of the attachment and hindering its movement. For some time I have been very successful in mixing up a paste of temporary stopping and chloroform. This does not harden in the vulcanizer, and it is very easily removed by dissolving it with chloroform, or by turning a small Bunsen burner down very low and heating the wings of the clasp. When it has become hot, but not hot enough to burn the rubber, the clasp can be grasped gently with a pair of pliers and rotated from side to side. If rubber should get into the joint of the attachment, it can be loosened in this manner, by heating the clasp. We will need to heat it a little hotter and we must be careful not to burn the rubber of the plate.

Kayle Attachment

The Kayle attachment has three parts. The button (Fig. 310) which attaches to the clasp is flat on the top to limit the side to side motion.

If we want to obtain more side to side motion this flat top is filed "V" shape. The extent of this movement must be experimented with before we assemble the piece. The greater the movement desired the greater amount of filing we must do. The second piece is called the "sheath" and fits between the cover and the clasp (Fig. 310). It has a slot in it

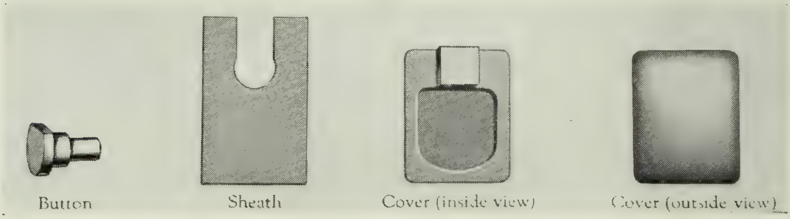


Fig. 310. The separate parts of the Kayle attachment.

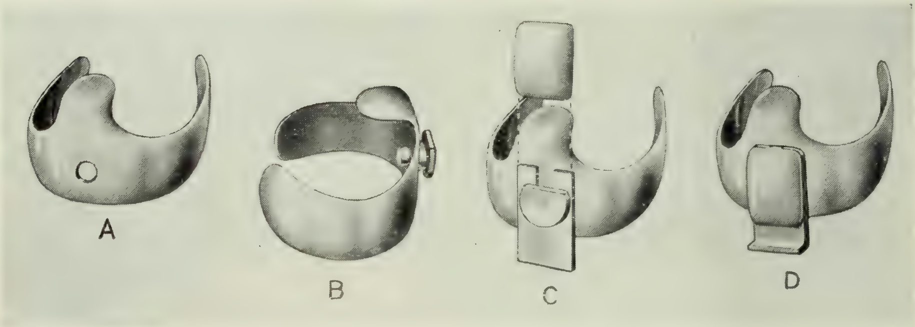


Fig. 311. The various figures delineate the successive steps in assembling and attaching a Kayle attachment to a clasp. A. The clasp with hole drilled for reception of the button section. B. The button section in place. C. The sheath in position, and cover ready to be placed. D. The cover in place, and the clasp and attachment ready for union with the plate of the denture.

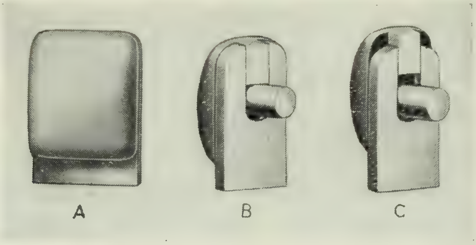


Fig. 312. Shows variations to different degrees of slide motion.

to allow the button to go through into the cover. The cover, or the third piece, has a depression in it (Fig. 310) to receive the head of the button, and also a raised portion to fit into the slot of the sheath. The outside of the cover is perfectly smooth so that if it must be placed in any position where it is exposed to the tongue it does not irritate it (Fig. 310).

These attachments can be used on the flat plate clasp by just boring a hole in the clasp. If we use them on a wire clasp, we must solder a piece of flat plate to the wire to hold the button; if used on a double wire clasp this plate will be soldered between the wires.

The clasp is assembled on the model with the saddles, and the position is determined where we are to place the attachment. When this has been decided upon, a film of wax is flowed on the clasp and the attachment is pressed into position. The point on the button will make a little hole in the wax, and, with a spear shaped drill, a hole is drilled through the clasp (Fig. 311 A) at this point. We must next determine how much hinge motion we wish to have, because if we press the button in too far, we will prevent all hinge motion, which is rather limited anyway. The button is pushed in the hole, and it is much easier to work with if it is a tight fit. It is fastened with sticky wax on the inside of the clasp, and if it is loose, it must be invested. The outside of the button, or the head side (Fig. 311 B) is covered with an anti-flux, and soldering can be done in the open flame with a high karat solder, if the button fits tightly, the clasp being held with a pair of soldering tweezers. The solder is smoothed off on the inside of the clasp, to allow us to place it back on the cast. The sheath is placed in position between the clasp and the button, as in Fig. 311 C, and is covered with anti-flux. We must be careful to see that there is no anti-flux on the sides of the sheath, or there will be no hold for the solder. The anti-flux should only cover the head of the depression on the inside of the cover, and that portion of the sheath which comes into contact with the button and the clasp. The cover is fluxed and put into position, and it is here that we must determine the position of the cover to allow for the up and down slide motion. Fig. 312 A shows the cover in position; B shows it in such position that there is a small amount of slide motion, and C shows it in position where there is considerable. The degree of motion will depend on the type of the denture we are using it upon. We will need much more motion in cases where there have been recent extractions, than where the teeth have been extracted a long time. We will also need much more motion in cases where the ridge is soft than in those where the ridge is hard. We will need more in Classes I and II types of cases, than we would in Class III. Where we are using the attachment simply to permit the clasp to go over a tooth that is in malposition, and the ridges are hard and of a Class III type, it is not necessary to have any slide motion at all. When we determine the extent of motion needed, the cover is fastened with sticky wax and the sheath is also attached to the saddle with sticky wax. The appliance is then invested, soldered and tried back upon the cast to see that it works properly.

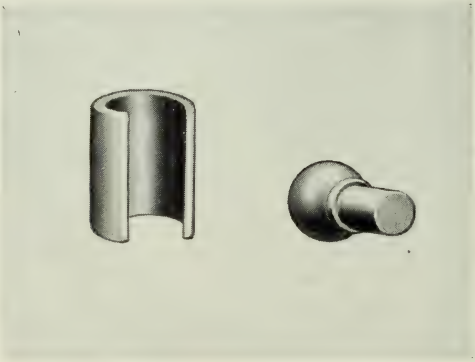


Fig. 313. Roach round ball attachment.

Roach Attachment

I have said that the Roach attachments are really stress breakers and not clasps, yet that portion which grips the ball, or the button, acts and can be loosened and tightened just the same as a clasp. The round ball attachment can be used in Class III types of cases for small dentures. The part which carries the ball (Fig. 313) is placed in an inlay, or on the side of a crown. The tube portion is placed upon the saddle and cut to the proper length. In this type of case, I believe it should only be used as an anterior attachment to prevent showing of gold. If we use it both anteriorly and posteriorly, we will have too much side to side motion, and will need some supplementary stabilizer.

When assembling the attachment a piece of plate should be cut and soldered on the end of the tube, to act as a stop, to prevent too much settling. I have seen many dentures which had settled so far that the ball came out of the top of the tube. A Class III type of denture, which has an abutment anterior and posterior to the opening, and is similar to the true Bonwill type, is a border line between a bridge and a denture.

I use very few of this form of attachment, first, because I do not care to cut into the teeth that have not already been cut into; and second because I believe the slotted attachments of the Chayes or the McCullom types would serve better. Within the last two years I have used only one of these Roach ball attachments and that was applied to a first bicuspid which held a Richmond crown that needed replacement.

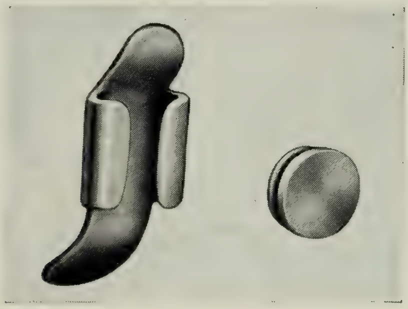


Fig. 314. Roach flat attachment.

The attachment is a little clumsy, and if it is placed slightly lingually it is a great annoyance to the patient's tongue.

These objections have been overcome in the Roach flat attachment. The Roach flat attachment (shown in Fig. 314) has proven a great help in Class I, upper cases, where the indirect retention is too short for us to use an ordinary clasp. In referring to this figure I would advise the student to reread the rules that decide whether we should use the Roach attachment or not, illustrated in Figs. 193, 194 and 195. The Roach attachment necessitates crowning the tooth, or using a Carmichael inlay, or a pin-ledge inlay.

The best method of using a Roach attachment is to place the inlay in position before it is cemented; then an impression is taken with the saddle in the mouth. The inlay is placed in the impression, and the exposed surface is covered with a very thin film of wax, or oil, to prevent the plaster, or the artificial stone, from adhering too tightly, as the inlay must be removable from the cast when we solder the button upon it. The attachment is located in its proper position, and the button is fastened to the inlay with sticky wax. It is soldered, but before soldering be sure that the depressed ring in the button is filled with antiflux, or it will fill with solder. It can be soldered in the open flame if we have the proper pair of lock pliers and use only a tiny bit of solder.

When this has been done, and it is placed back on the cast and the female portion of the attachment is fastened to the plate in the proper relation to the button, it is lifted off and soldered, care being taken not to allow solder to enter the slot. The slot should be anti-fluxed before soldering.

When assembling the parts the upper tip, on the female portion, should press against the basilar ridge of the inlay. After having soldered the attachment to the plate we call the patient in, put the inlays in the mouth and cement them, first having tried them to see that they fit in the mouth in the proper relationship to the attachments. If they do not, we will be compelled to resolder the button in the proper position, which will necessitate our buying a new button, as it is practically impossible to remove a button from an inlay after it has been soldered. When the inlays have been cemented and the plate of the denture is tried in the mouth, we will find that it has a tendency to sag on the rear border. This is overcome by bending the tip up against the inlay with a pair of pliers. When the back edge of the plate is sufficiently tight against the tissue, so that it is not noticed by the patient's tongue, we take it into the laboratory, invest it in asbestos and plaster, and flow solder over the tip to tighten it and prevent it from bending back under the stresses of mastication. The patient is kept and the piece is again tried in the mouth to see that everything is correct, before taking a bite.

These cases prove remarkably successful, and I have had one where the patient was in an automobile accident and two Carmichael inlays were loosened. After the patient had recovered and came out of the hospital, I only had to recement the inlays and repair one tooth which had been broken. I do not think that this attachment permits as much strain upon the abutments as one of the slotted attachments would, in Class I cases because there is more room for settling, due to the fact that there is considerable hinge motion. Of course this is overcome in the slotted attachments if we use a stress breaker between the slotted attachment and the saddle.

CHAPTER XXII

Double Wire Clasps and the Construction of Tangs

There are occasions where it is advisable to use a double wire clasp. It is stronger than the single wire clasp and has an advantage over the flat plate clasp in that there is not so much surface resting against the enamel, and it can be better adapted to the contours of the teeth, especially if they are rather irregular. While the double wire is stronger than the single wire clasp, it lacks the flexibility of the Gillett clasp. In my own practice, I seldom use the double wire clasp, but the student should be familiar with the technique if for no other reason than to increase his skill in wire bending. The double wire clasp is difficult to make and we waste a great deal of gold if we do not proceed in a proper manner.

The clasp should be carefully outlined on the cast the same as for a flat clasp. The wire should follow the same outline as the outline of the flat plate clasp, one bend of the wire passing above and one bend of the wire below the height of contour. It can readily be seen that this clasp can only be used on teeth that are long, from the gingiva to the occlusal surface, or there would be no advantage in making it, as the half round wire clasp, or the flat plate clasp would serve as well. One of the reasons for using the double wire clasp is its flexibility, and if the loop is too narrow it lacks flexibility, and at the same time is apt to hold particles of food, rather than to shed them, which is one of the objects of the loop clasp.

I begin by making a pattern of soft phospho-bronze wire, 19 gauge, the same gauge as the gold wire we are going to use in the clasp. This is straightened out and we cut a piece of clasp wire the correct length, allowing a little extra length for waste. (Fig. 315 A.) In straightening out the bronze pattern wire, I do not straighten out that portion which fits into the lug seat, as this gives us the starting point where we are going to begin bending the wire, and if we provide a little surplus when we cut the gold wire, it more than compensates for this little loop. (Fig. 315 B.)

We begin bending the gold wire over the end of a pair of Peeso pliers, and we must be very careful to anneal the wire, as the loop is very short and bending is liable to cause a fracture. When bent quite close together, it can be closed entirely by placing it between the jaws of a pair of flat pliers, such as the Bernhard side cutting pliers, or the Aderer wire bending pliers, and pressing the wire until the loop is entirely closed. (Fig. 315 B.)

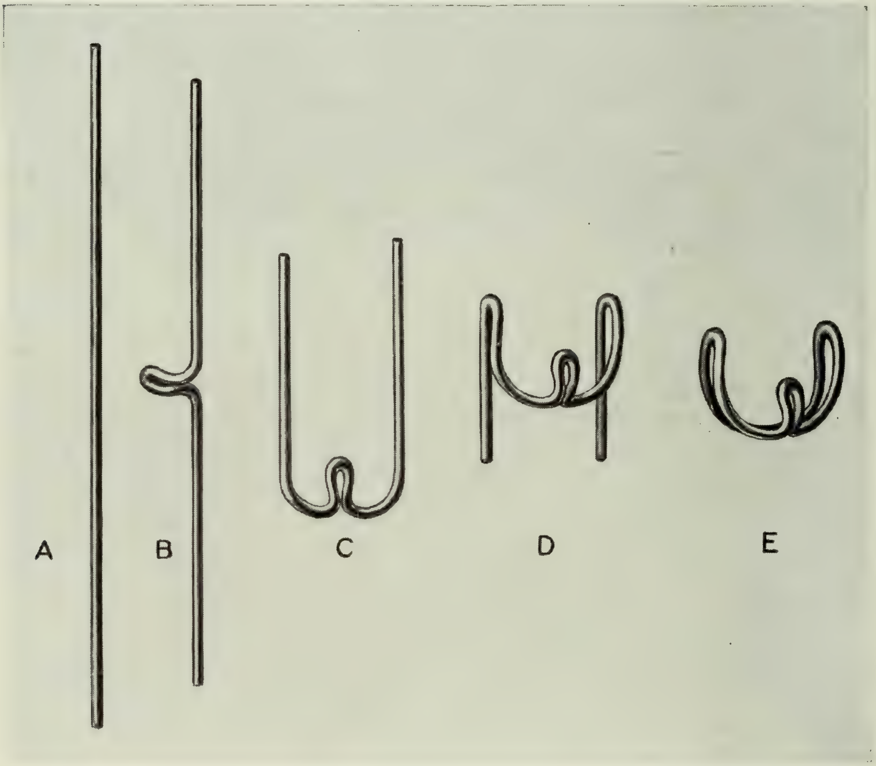


Fig. 315. Technique for making double wire loop clasp. Dr. Hart J. Goslee, *Items of Interest,* March, 1918.

The two ends of the wire are then bent downward over the occlusal embrasure. The ends of the wire are then separated and bent around to correspond to the upper outline of the clasp, (Fig. 315 C), first on the lingual and then on the buccal side. We must be careful to anneal often, especially when we are making the short bends. When we reach the end of our outline, we bend the wire around, down and back upon itself as shown in Fig. 315 D.

This is the difficult part of the bending, as it is hard to make this lower wire conform to the contour of the tooth. The two wires are brought around and they cross each other under the occlusal lug. They are marked at the crossing, and I prefer not to cut them so as to form a butt joint, but at 45 degrees to one another so as to form a lap joint. They are soldered together, and at the same time some solder can be flowed in the loop of the occlusal lug to strengthen it.

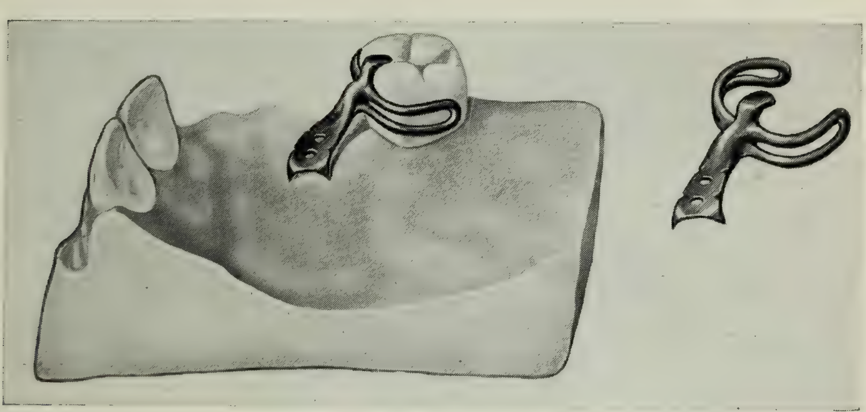


Fig. 316. Double wire loop clasp, with occlusal rest, and tang suitable for vulcanite work.

Some men do not solder the ends together, but they extend them to form an attachment to solder to the plate, or they bend them in the form of loops to hold in the vulcanite if they are making a rubber denture. I do not believe this is good practice. It is much better to finish the clasp and solder a piece of plate between the two wires just beneath the lug to hold them together, as shown in Fig. 316, and to strengthen them. Otherwise we will find that all the stress will be brought to bear upon the lug and the lower wire, and as the wire we use is only of 19 gauge, it is too slender to support the denture. This is obviated if we solder the two wires together with flat plate. The end of this piece of plate is shaped so as to get a hold in the rubber, or to serve as an attachment to a gold plate. (Fig. 316.)

With a double wire clasp, the little loop which forms the lug, does not need to be braced with pure gold and solder. All that is necessary is to flow solder into the loop. This can be done in the open flame, when the loop is finished, or we can wait until we attach the tang which connects with the plate, and stiffen the lug wire at that time.

Fig. 317 shows a number of wire clasps designed for bicuspids and molars. The one on the bicuspid in the upper row (Fig. 317) has had the loop soldered together part way around. This makes a very strong clasp, but defeats one of the purposes of the double wire clasp, which is flexibility.

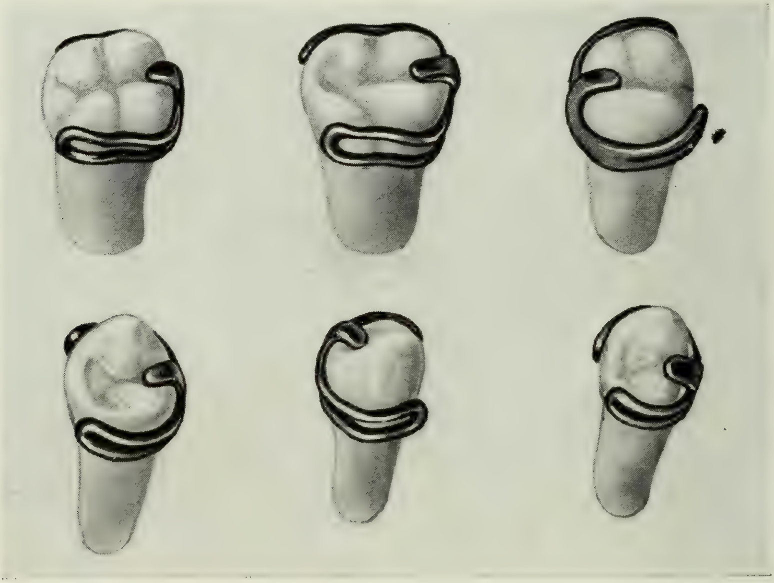


Fig. 317. Wire clasps designed for bicuspids and molars. Dr. Hart J. Goslee, *Items of Interest,* March, 1918.

There are a number of forms of wire clasps which have not been before mentioned, which we can use to advantage. One, with which I have had considerable success, is a modification of the double wire, and has some of the advantages of the Gillett clasp. There are occasions where teeth are so tapering that it is necessary to insert an inlay in the buccal pit and so contour the inlay as to form a little bulge, or button, on the side of the tooth. A single wire clasp such as the Gillett is apt to slip off more easily than if the wire entirely encircles this little button. (Fig. 318 B.) In such cases I very often start out as though I were making a Gillett clasp, and instead of terminating the end immediately under the button, I turn it around the button and solder it upon itself. This forms a little loop which gives a better hold upon the button. I might say in passing, that these little buttons are very successful and require very little mutilation of the teeth. All that is necessary is to cut a small round cavity in the buccal pit, and form a wax pattern which is not flush with the surface, but rounding out, spherical in form. Such places are easily kept clean and I have never had one unseat after it was cemented. Some men prefer the old method of packing gold with a mallet and this may be successful also, although I have seen such fillings scale off when they were not well malleted. This form of clasp is also useful in certain shaped teeth which have prominent contours on them. We can take advantage of the contour to put the loop around it.

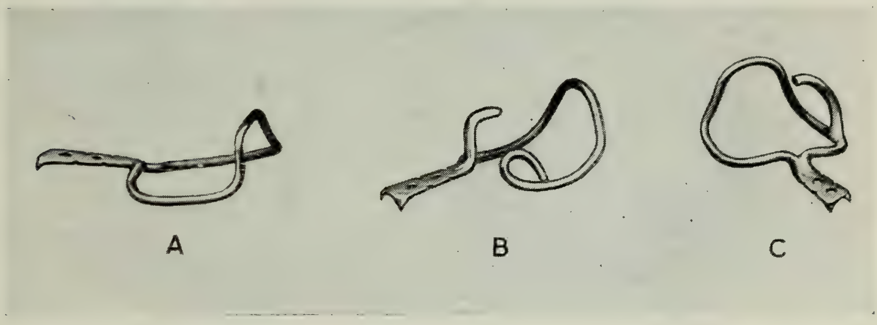


Fig. 318. Designs for wire clasps where a distal occlusal lug cannot be used. A. The wire crosses the distal embrasure. B. There is a mesial occlusal lug, and a terminal loop which engages a spherical filling in the buccal groove. C. A lug resting in the buccal groove of a molar.

Open Loop Wire Clasp.

There are several forms of wire clasps which are called open loop clasps. The first, Fig. 318 A, can be used to advantage where it is impossible to seat a lug on the mesial occlusal surface of the tooth, but where we can cross the embrasure with a wire. This is somewhat of a modification of the Jackson principle.

The second, Fig. 318 B, is useful where we can utilize a lug on the mesial occlusal surface. The wire of the clasp runs around and across the distal embrasure, giving considerable play. Fig. 218 B also shows a clasp terminating in a loop to catch on a filling.

The third is where we can get no occlusal lug but where it is possible to rest a lug against the buccal groove of the molar. (Fig. 318 C.) They are very ingenious and are mentioned to show how advantage must be taken of the natural contours of the teeth.

The Embrasure Hook Clasp.

Dr. Roach has developed a clasp which is quite successful and is called the "Embrasure Hook" for bicuspids. This is a modification of the Jackson crib idea, and I make them by burnishing a piece of pure gold on the lingual side of the tooth, running my wire over the mesial embrasure,

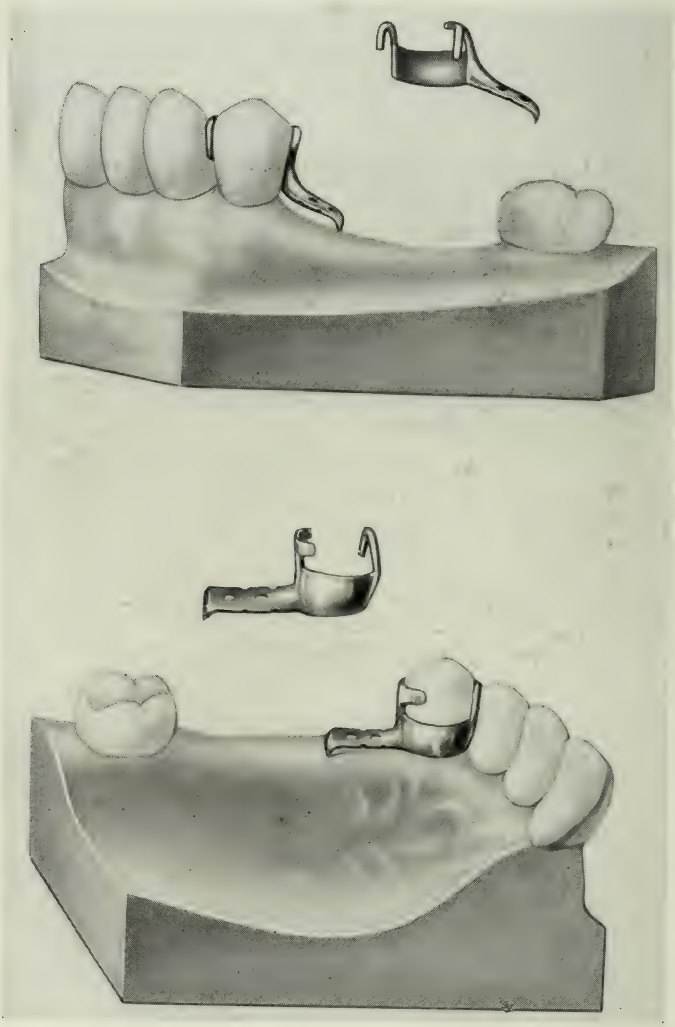


Fig. 319. The Roach Embrasure Hook clasp. Upper illustration shows the labial aspect. Lingual aspect is seen in lower illustration.

and around the lingual side of the tooth, up over the height of contour, and attaching an occlusal rest on the distal loop. This is illustrated in Fig. 319, which shows both lingual and labial views. It is also very useful on bicuspid teeth when the patient objects to the display of gold.

It is surprising, but it does not show as much gold as the ordinary encircling wire clasp.

Attachment of Clasp to the Plate

The attachment of the clasp to the plate is an important consideration. With a gold base, this is rather easy, especially where we have anterior and posterior support, and for the ordinary saddle where we have anterior and posterior support, the most logical place for attachment is just under the lug seat. Provision can be made when we cast the saddle, to allow the gold to run up and meet the clasp. This allows us to have both wings of our clasps adjustable.

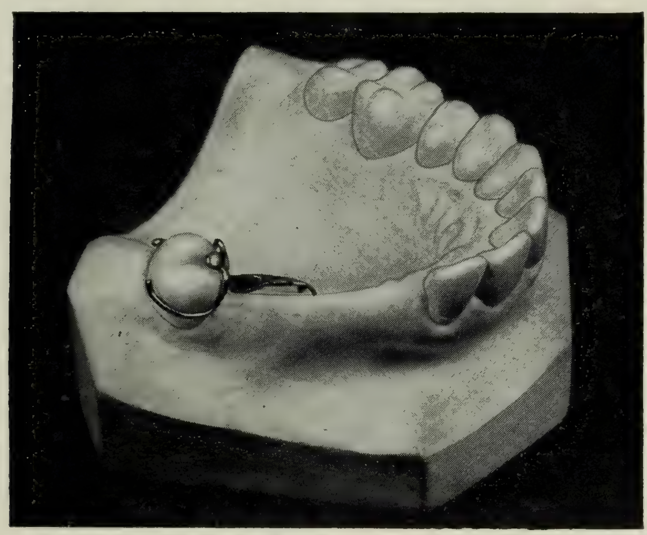


Fig. 320. Molar clasp with plate tang for vulcanite work. The extreme end corners of the tang are turned downward to permit vulcanite to pass under it.

The lug at times may be attached to the saddle, separate from the clasp. This is an excellent idea but must be used with judgment.

When attaching clasps to vulcanite, I generally make wings of flat plate clasp metal, and so shape them that they allow the ends of the clasps to be free. I generally attach the ordinary wire clasp under the lug. With the flat plate clasp, I make the attachment a little to the lingual of this; that is at the mesiolingual or the distolingual angle of the tooth, according to the direction in which the clasp is facing.

The only clasp which I attach on the lingual side is the mesiodistal clasp, and I take great care here to see that there is no gingival pressure. My attachment from the clasp to the plate always bridges over the gingiva.

When we are preparing our casts for this type of clasp, I generally cut a small piece of Ash and Sons No. 7, soft metal, to cover the gingival margin where the tang is to cross it. This prevents placing the tang too close to the model; or, if we are swaging a gold plate, it prevents gingival pressure at this point.

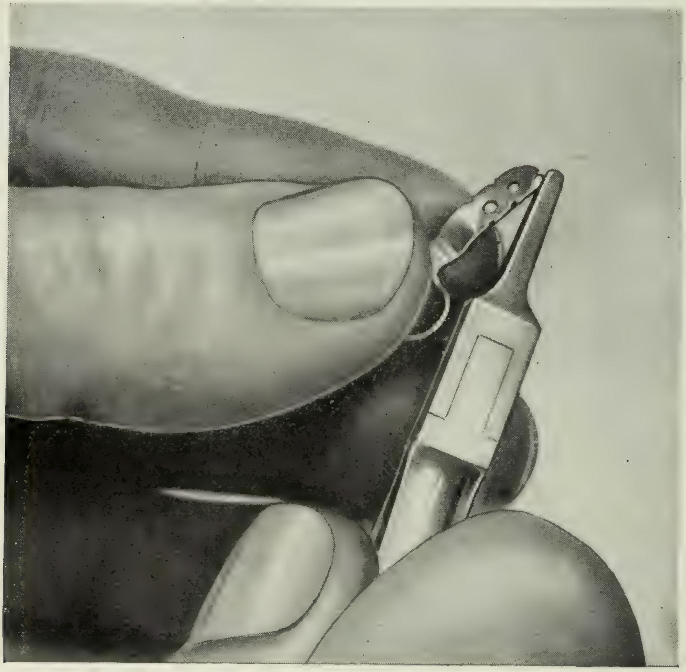


Fig. 321. Technique for bending down the corners of the tang with Peeso pliers.

When attaching tangs on clasps to be used in vulcanite work they should never fit tight against the gum, nor touch the gingival margin, or the rubber will not get under and give us a good hold. If they do touch the gingival margin, the settling of the plate will cause a recession and ultimate pyorrhea pockets. This is particularly true of the continuous clasps. Tangs should clear the gingival margin at least 1 mm. (Figs. 316 and 320.) If they fit too close to the gum beyond this area, I overcome this by bending the ends of the tangs down. It is very easy to do this by grasping the tang with a pair of Peeso pliers, allowing the pliers to slip off the point. (Fig. 321.) This flattens the plate out, at the same time bending it downwards. This bent corner acts like a little leg, and holds the flat plate of the attaching tang up from the cast. When the flask is closed, the rubber cannot force it down. If the point should be pushed into the cast a little way, it would protrude from the vulcanite in the form of a point, which can be ground off with a stone.

These attaching tangs should never have the sides parallel, but should widen out as they recede from the clasp; otherwise they will work loose from the vulcanite. I take the added precaution to notch the sides of them with a file and with a plate punch make a few holes to allow the rubber to get a better grip. (Fig. 320). Some men prefer the use of wire loop tangs to attach in the rubber, but it has been my experience that they break more readily than the flat plate. Care should be taken to so plan the position of the tang, as to keep it away from the teeth that we are to grind into position.

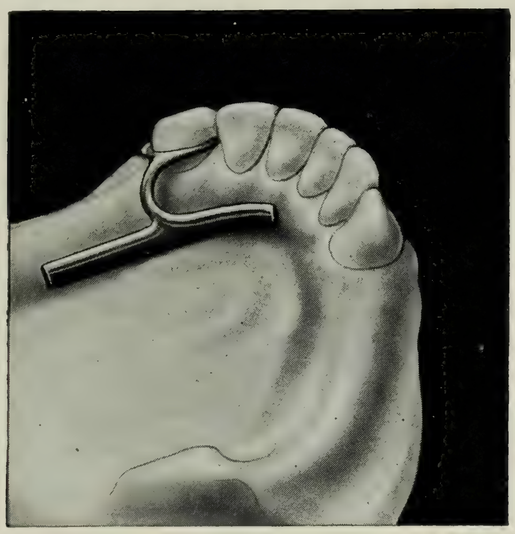


Fig. 322. Technique for connecting clasp with lingual bar, the connecting wire bent in a semicircle to clear the gingival tissues.

This requires a nicety of location, because if the space is small, it is hard to get a tooth to go in, and if we place the tang too far to the lingual, it produces bulkiness of the vulcanite and, sometimes when we place one in a thin section of rubber, we are very liable to have a fracture start at this point.

Where we are using a lingual bar, it is always advisable to solder the tangs to the bar, as this method gives us a much stronger denture. In attaching the clasp to the lingual bar in Class I cases, I never run my tangs directly downward from the clasp to the bar, as the slightest settling causes them to impinge upon the gum at the gingival margin. I have seen a number of these cut through the peridental membrane, with the resultant loss of the tooth clasped. Hence I take the simple precaution of shaping the connecting wire in the form of a semicircle which starts at the clasp, extends backward missing the bulge of the gum at the gingiva, circling around it and connecting to the lingual bar below. (Fig. 322.)

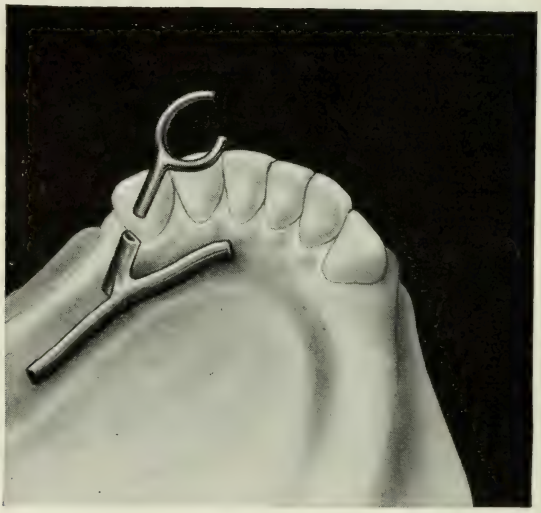


Fig. 323. Lingual view of a detachable clasp.

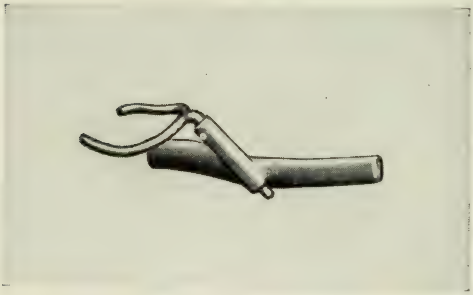


Fig. 324. Detachable clasp, apart from the cast, and showing the method of union of clasp with the tube.

I think it has an added advantage of acting somewhat as a stress breaker. It should be placed at least 1 mm. away from the gum; then if by any chance the lug breaks, and allows the plate to settle, the tang will not dig into the tissue.

Detachable Clasps

There is a form of attachment which allows us to detach our clasp from the denture when it is necessary to repair the clasp. I believe this has been developed by Dr. Jackson of Philadelphia. I call it a "detachable clasp." Fig. 323 shows the lingual view of such a clasp and Fig. 324 the appliance off the cast.

This clasp is made in the ordinary manner, and a piece of No. 14 gauge half round wire is soldered to it. This wire extends from the clasp to the ridge of the cast and about 1 mm. into the cast. A hole must be drilled to allow the wire to go in. Then a piece of half round tubing of sufficient length, is slipped over the 14 gauge half round wire and extended from the clasp to the cast, but not into the hole. If we are using it in an ordinary rubber plate, a tang must be soldered to this piece of tubing, to get a hold in the vulcanite. If we are using it on a gold plate, the half round tube is soldered directly to the plate. If we are using it on a lingual bar, it is soldered to the bar. The clasp is made with the half round wire soldered on it, the tube is slipped over and it is assembled into position on the plate, waxed and invested, and the clasp with the half round wire is slipped out of the tube. The tube is then soldered to the plate, or to the bar.

Care must be taken to see that the tube is filled with investment, so that solder will not flow in, and the same thing must be observed when we are packing our vulcanite around it. It must then be filled with plaster so that the rubber does not clog it.

We are now ready to attach the teeth. After this is done, the end of the tube which rests against the cast is counter-sunk with a round bur. The half round wire is slipped into the tube with its clasp attached, and the wire is cut off to about 1/2 mm. beyond the edge of the tube. The appliance is turned upside down and the clasp is held on an anvil immediately above the point where the half round wire is soldered to it.

With a light riveting hammer, the projecting end of the wire is riveted into the counter-sunk portion of the tube. When this is done, the head is smoothed off with a stone. This form of attachment has the advantage, that if the clasp is broken, the head of the rivet can be cut away with a round bur and the half round wire pushed out of the tube, together with the unbroken portion of the clasp.

A new clasp can be prepared and replaced in the tube and reriveted, without the necessity of revulcanizing the work. I think the time involved, however, in making one of these, is about the same as when we have to revulcanize.

CHAPTER XXIII

Continuous Clasps

I believe that the first continuous clasp was made by Dr. J. Wright Beach of Buffalo and was used to stabilize a lingual bar. It acted in the capacity of an indirect retainer. The writer thinks it was a distinct advance in partial denture construction, and full credit should be accorded to Dr. Beach for the idea. (Fig. 325.)

Dr. Beach called his appliance the "wrought continuous interdental support." Describing it he says:*

"It is used in conjunction with the lingual or palatal bar, and is made of 20 gauge, round wire, by fitting each tooth with a crescent shaped piece, tacking them together with sticky wax, investing and soldering them into one continuous whole. It is placed just incisally of the lingual eminence of the tooth and has the combined advantages of making each tooth above which it passes contribute a fraction of support to the completed denture; it prevents 'heel raising,' forms a splint for partially loosened teeth and prevents the formation of calculus about the necks of labial teeth."

It is called by some men the "continuous clasp" and by others a "double bar." Some men, such as Dr. Woodworth of Buffalo, who was formerly associated with Dr. Beach, make it by the casting process and call it a "continuous clasp."

The author constructs his continuous clasp of pure gold and clasp wire, fusing the two together with Ney's B-2 casting gold. He believes he has less erosions than when he made it by the casting process. In fact, in the years I have been using it since 1913, I do not know of one case of erosion.

The author finds them of the greatest assistance in large surgical cases where he supplies one-half of the jaw. His construction is heavier than

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* *Dental Items of Interest,* January, 1924.

Dr. Beach's and can well withstand the stress of mastication. To properly appreciate their value, one must use one on a Class I, lower case, which has been giving some trouble with the denture rising from its seat, or rocking from side to side, placing an undue strain on the clasped teeth. Or in one of those cases which has a flat ridge, with a loose and flabby mylohyoid muscle constantly getting under the lingual edge of the plate, a fold of the muscle being pinched as the patient bites down upon it.

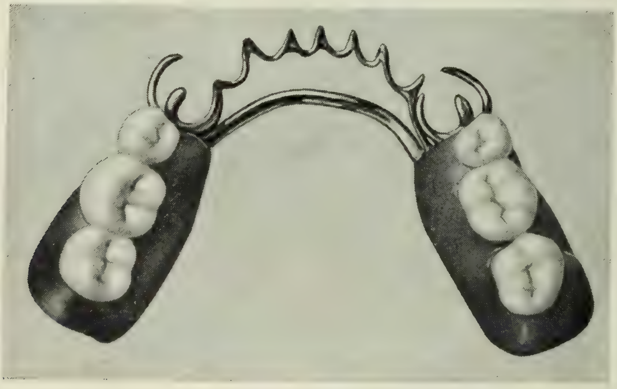

Fig. 325. Dr. Beach's "wrought continuous interdental support." *Dental Items of Interest,* January, 1924.

I know of no more aggravating condition. Trimming away the lingual side of the plate does not seem to help. Since using the continuous clasps in these cases, that trouble has been eliminated from my practice. The greatest advantage is the distributing of the stresses among the teeth upon which the continuous clasp rests, not placing all the strain upon a few teeth as was the case in the old fashioned denture which readily loosened these teeth.

I have seen cases where teeth already loosened became tight after a continuous clasp had been utilized.

Another great advantage of the continuous clasp is the fact that, when it is properly constructed to rest upon the basilar ridge of the teeth, it prevents excessive settling. When such dentures do settle, strange to say, they do not force the teeth forward, but pull the continuous clasp away from the teeth, leaving a space between the anterior teeth and the clasp, which the patient notices with the tongue. This is a warning to the dentist that the denture should be rebased. The fact that this type of clasp acts in the capacity of a splint which is readily removed and cleaned, is another advantage. Many periodontists have experimented with splints for supporting loose teeth. These have not proven successful. They require mutilation of the teeth and when they are fixed, collect food debris. None of these objections applies to the continuous clasp when used as a splint.

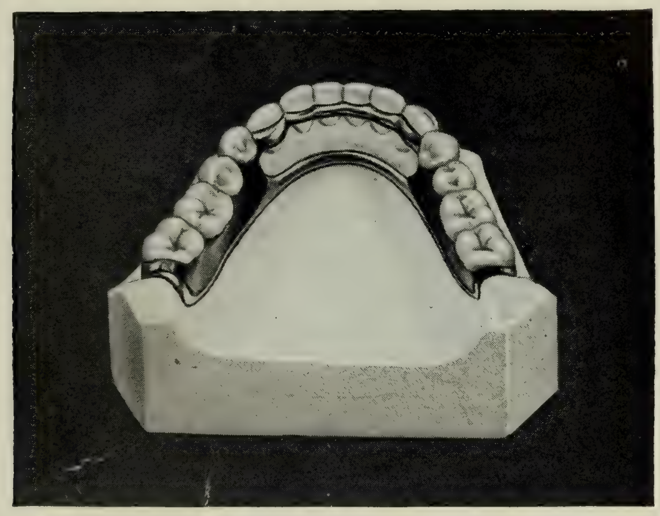

Fig. 326. The author's design for a continuous clasp, in a Class I, lower case, the natural teeth being very short.

A fact not recognized by the profession generally, but fully understood by the orthodontists, is the part which the lips and tongue play in the movement of the teeth. The double bar or continuous clasp prevents movement of the teeth by the tongue. Where teeth have been loosened by pyorrhea, the movement is constant, first by the tongue and then by the lips, which tends to loosen the teeth in their sockets very quickly.

The continuous clasp prevents the lip from forcing the loosened teeth too far lingually. With this type of case, where the teeth have been tilted forward by the tongue, I have experimented with detachable bars, which could be placed a little lingually, not resting upon the teeth, and in a few days time, I have found that with the tongue pressure eliminated, the teeth moved back to the bar, nearer to their normal position and tightened in their sockets.

The writer believes there is a use for these appliances by the orthodontist and periodontist which has not been appreciated. One prominent orthodontist in New York City is experimenting with continuous clasps at the present time, for excessive overbite cases, and mutilated cases.

In cases where the bicuspids and molars have become abraded and they have begun to acquire a lingual inclination, the continuous clasp prevents it from going further. The building up of the teeth with inlays only aggravates the condition, and, as most of these cases have teeth missing, there is no reason why the continuous clasp cannot be used to advantage.

Where we have very short teeth in the anterior part of the mouth, as for example, a Class 1, lower, with nothing remaining but the six anterior teeth, and the cuspids to which we attach our clasps are short, it is practically impossible to obtain any hold and the clasps constantly slip off when chewing.

The one shown in Fig. 326, had such a history. Two plates had been constructed which could not be worn. This one I made for an office assistant, and I have had it under constant observation for six years. In that time there has been absolutely no erosion of the teeth, and the patient can chew the hardest kind of breads without discomfort. None of the teeth have moved from their position. This is proven by the fact that I can take a modeling compound impression at any time, pour a cast and the original denture made six years ago, will fit that cast. There were erosions upon the two cuspid teeth on the labial faces, from cast clasps which a previous dentist had made. These were filled with synthetic cement and show no further wear, although the present clasps rest upon them. This is due partly to the fact that the plate does not move and partly because round wire clasps were used.

I have had another denture made for another office assistant, under close observation for four years. When I took this case, the two cuspid teeth had almost been ruined by cast clasps, the cavities extending from the lingual around to the labial surfaces and very close to the pulp. The pulp was insulated with cement, covered with synthetic porcelain, and a continuous clasp similar to the one shown in Fig 326 was made. I hesitated to make this denture because both on the lingual and labial faces of the teeth, there were faults in the enamel, consisting of small pits, which were very sensitive to the explorer. I fully expected that erosions would follow, but, strange to say, where the pure gold of the continuous clasp has been resting upon the teeth, we now find no sensitive areas. Yet both above and below the clasp these sensitive areas remain.

I believe there is some catalytic action in the gold, or some action which prevents the growth of bacteria. If we are to accept Dr. Pryor's teaching, we will believe this is true. Many men ask me why I do not make these clasps of platinum, as platinum inhibits the growth of bacteria and is less easily burned in the construction of the work. Both of these arguments are fallacious. Pryor has shown that the inhibiting action of metals on the growth of bacteria are in the following order: Mercury, lead, silver, pure gold, and platinum least. Also we know that if this were true, the cast clasp with high platinum content would inhibit tooth erosion which it does not.

The author has proven to his own satisfaction that a flat plate clasp, made of a high content platinum permits erosion of the teeth more readily than the same clasp lined with pure gold. In former years, when I was using flat plate clasps extensively, I often found that by changing them to a matrix clasp, erosions ceased.

The point about platinum not burning when solder is fused on it is also a mistake. If the solder has any zinc in it, it will burn more readily than pure gold.

The first continuous clasp made by the author was constructed in 1913. It is worn by the patient to the present day, and is shown in Fig. 10 in the first chapter of this book. The patient presented a condition of hard papilloma which was removed by a Philadelphia surgeon, with a warning that the continued use of the lingual bar would develop a cancer. The patient returned to the dentist and he made her an old fashioned swaged gold plate, which pressed upon the gingival margins of the teeth, causing recessions and extreme sensitiveness. He then tried another lingual bar, with cast clasps which eroded the teeth and they had to be filled. The papilloma returned, due to the plate again settling. The surgeon again removed the papilloma and I was asked if there was not some form of denture that could be made without pressing upon the gingiva, or on the papillomatous area. The only type that I could find in the literature of dentures was Dr. Beach's.

I constructed one, but as the continuous clasp was made of light wire, the patient bent it a number of times. I strengthened this by burnishing pure gold upon the cast and uniting it to the wire with 20 karat solder. It proved entirely successful and was worn until May 1926, when I found it necessary to rebase the denture. This lead me to adopt these types of clasps in surgical cases, and in 1916 I began using them for ordinary cases. I have used the continuous clasp in a very great number of cases and I have seen no erosions, even though some of the patients were far from cleanly, and many of them had sensitive areas due to wearing the old fashioned type of swaged gold, or rubber denture. After relieving the gingival pressure, the gum resumes its normal condition and the sensitiveness due to the retention of food products on the cementum disappears.

Dr. Beach, (as quoted) very ingeniously constructed his appliances of fine wire, bending little loops to fit each tooth and soldering them together. This makes a beautiful, light appliance, but must be used with judgment because a patient inclined to be rough is very liable to bend it readily. Sometimes it breaks merely due to the stress of mastication which is also true of the soldered and the cast type. In the last year and a half, I have been soldering continuous clasps with casting metal, and have had no breakages in the lower, Class I cases.

Technique for Constructing Continuous Clasps

The method of constructing a continuous clasp is quite simple. An artificial stone cast is made from the impression; in fact I use the same cast that I intend to construct the denture on. The clasp is outlined, so that it rests upon the basilar ridges of the teeth, as it bothers the tongue less at this point. If it is made above this point, if the plate settles, it is extremely troublesome. If it is placed below and the plate settles, it is very liable to force the teeth forward, although I have not experienced this in my practice. It must be placed on the enamel and not on the cementum. If placed on the rounding portion of the basilar ridge and there is any movement in the denture, it will rotate around the curve of the basilar ridge without placing undue strain upon the teeth. This point was first mentioned by Dr. Cummer in describing properly constructed clasps on cuspid teeth, and I find it applies equally as well to the continuous clasps.

In no circumstances should continuous clasps be placed below the height of contour, whether on anterior or posterior teeth. There must be no snapping or forcing them into place, or they will act as regulating appliances. If they are properly placed, they will, on the other hand, act as retaining appliances, distributing the stresses so that no one particular tooth is strained. A pattern is made in tinfoil 36 gauge and it should be cut 2 mm. wider than the outline of the clasp. This is extremely important. This pattern is flattened out, laid on a piece of 36 gauge pure gold, and the gold cut with a pair of sharp shears. The pure gold is then placed upon the cast, pressed with the thumbs to an approximate position (not rubbed) and then pressed to the proper position with the rubber of a lead pencil. A small egg shaped burnisher can be used to burnish it between the teeth. Do not puncture holes in the pure gold with the burnisher, as it is not essential that it should fit between the teeth tightly.

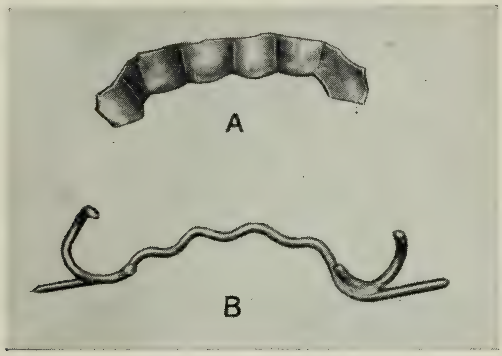

Fig. 327. Technique for constructing continuous clasp. A. Pure gold pressed and burnished to conform to the lingual surfaces of the teeth. B. Round wire bent to fit over the burnished pure gold, and then attached to it with solder. The clasps for the end teeth are also shown.

The next step is to trim the gold so that it terminates at the distal lingual angle of the last tooth. (Fig. 327 A.) It should not run on to the distal surface of the tooth as that will carry the solder out on the exterior wire that encircles the tooth, and stiffen it. A piece of 19 gauge, clasp wire is used and any good clasp wire can be utilized. The writer is using the formula recommended by the Bureau of Standards, with palladium alloy.

The length of the wire is determined by taking a piece of phospho-bronze wire and bending it to fit the curvature of the arch of the teeth. This phospho-bronze wire is very soft when annealed and can be bent with the fingers to fit the curvatures of the individual teeth. It should not be terminated, as the pure gold was, at the mesiodistal angle, but should be allowed to extend at least a quarter of an inch beyond, so that it will get a good hold in the investment. This wire is straightened out and a length of platinous gold wire is cut to correspond, thoroughly annealed and plunged into cold water.

We begin bending at a point between the central incisors using a Peeso pliers, or any round nosed pliers. I prefer to use the Nesbett pliers. The bending should be done in the form of a letter V so that the ends do not interfere with the further bending. (Fig. 328 A.) On the right side of the V, I grasp the wire in the Nesbett pliers, squeeze them and with one pressure, it takes the shape of the tooth. (Fig. 328 B.) The end of the wire is now projecting toward the teeth and it must be bent backwards, to allow us to try it on the cast to see if we have the correct curvature. (Fig. 328 C.) If we have, we place the pliers in position, and bend the wire around the next tooth. (Fig. 328 D.) The same procedure is followed until we reach the last tooth on that side, (Fig. 328 E) which is a cuspid, or a bicuspid. When the right side is finished, we proceed with the left side. We should anneal each time we make a bend and plunge the piece in cold water.

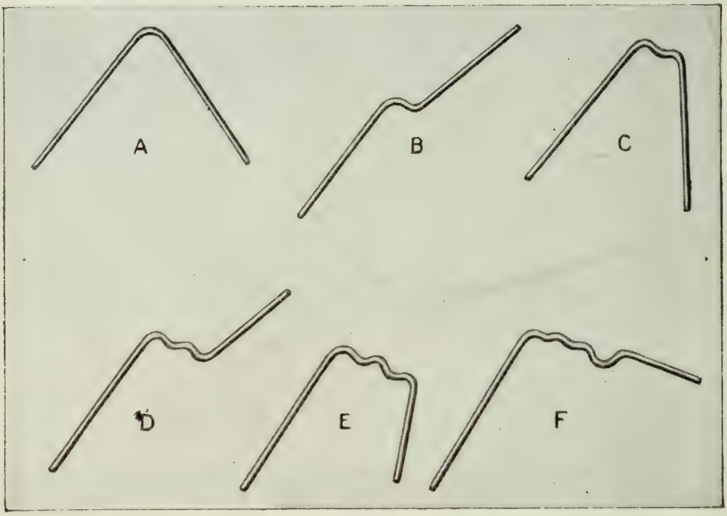

Fig. 328. Technique for bending the continuous clasp wire. A, B, C, D, E, and F show the consecutive steps in bending.

When we reach the end of the wire, the excess of wire which we have left is bent so that it will get a good hold in the investment. The left side of the wire is bent in a similar manner. (Fig. 328 F.) Each time we place it upon the cast, we see if it fits the tooth properly, and by bending upwards, or downwards with the free end of the wire, we can often obtain a better fit. (Fig. 327 B.)

When both sides have been completed, we bend the clasps. I very often use 20 gauge wire on very small cases, and 19 gauge for the clasps. In cases intended for a heavy bite, I use 19 gauge for the continuous wire, and 18 gauge for the clasps. If we care to, we can use 19 gauge throughout and then can bend the ends which were left for surplus to make an extension to hold in the investment in such shape as to form the clasps. Fig. 327 B shows one bent with 20 gauge wire with 19 gauge for the clasps. The clasps are attached to the continuous wire with sticky wax only to show their relationship. When all the bending has been done, we are ready to assemble. This much of the procedure should not take more than fifteen minutes at the outside. The pure gold is stiffened with a thin film of sticky wax and while the wax is still warm, it is pressed upon the cast with the thumbs which must be moistened. This pressure will seat the gold and make it fit even better than the burnishing has.

The continuous wire is heated and placed in position on the sticky wax, and covered with more sticky wax to hold it. If the clasps are made of separate pieces, they should be placed into position. They should not be made to fit tightly at this time, as it would then be impossible to remove the piece without distortion. The edge of the gold should be free of any sticky wax, to give it a good hold in the investment. That is the reason why we allow 2 mm. surplus. We next invest it in a horizontal position, preferably in a wire basket or wire box which prevents the investment from cracking. (Fig. 332.)

Either construct the clasps of the same wire, or allow a surplus of wire to extend into the investment. If we cut the wire short in the hope of saving wire, it will be impossible to place the wire back in the proper position, if by any chance it washes loose when we are washing the sticky wax out. (Fig. 327 B.)

Another advantage in having the wire extend into the investment is that sometimes we notice a space between the wire and the gold, and if this occurs, when the wire is thoroughly heated we can take the end of a slate pencil and push it against the gold. If we do this carefully, we will not break our investment, nor fracture the wire and it is practically the same as the hot wire bending described in a preceding chapter.

We should thoroughly flux our solder and our wires before soldering. If we use solder, I should advise a high karat solder, but as I mentioned before, I use Ney's casting gold B 2, which gives us a much stronger piece, with much less chance of fracturing.

When the gold is in a molten condition, the investment can be tilted from side to side, and the solder will flow easily. This portion of the clasp should be removed from the investment and ground and polished, before assembling to the rest of the bar. (Fig. 329 A.)

Do not polish the points where we hope to make contact with another piece of wire, as solder does not adhere well to a polished surface.

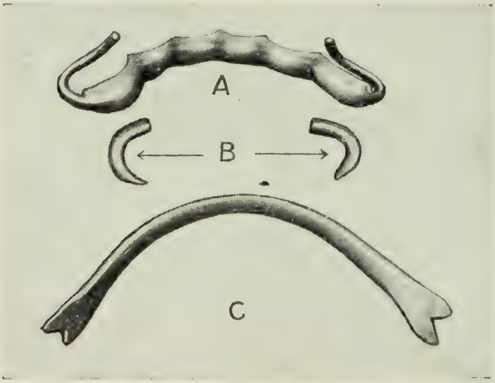

Fig. 329. A. Continuous clasp. C. Lingual bar. B. Curved attachments for uniting continuous clasp to lingual bar.

It is highly essential to finish the bar before assembling, as it is hard to polish it after it has been assembled.

It is best to try the continuous clasp in the mouth to see that it fits, before assembling the rest of the work. In fact it is best to try all sections of the work in the mouth, that is, the bars and the saddles, which give us a good check up on our impressions and casts, and if everything is all right, we can go ahead and assemble on the original cast. If there is some defect, relationship impressions will be required.

In a simple case like a Class I, lower, I go ahead and finish the gold portion of the work and try it in the mouth. If a clasp is out of position, or a bar not properly placed, it is a simple matter to cut it loose and replace it on the cast. In these simpler cases, I use stock bar of 9 by 15 gauge. I examine the ridges, and the degree of inclination of the anterior teeth, together with the inclination of the gum back of them. If it is a normal case, with hard ridges, take a narrow piece of adhesive tape and cut this to cover the pattern where the lower bar is to be placed. This is stuck on the cast and the lower bar is shaped to conform to this surface, which gives us sufficient relief in case of settling. If the ridge is medium soft, I use two thicknesses of adhesive tape. If very soft, I use three thicknesses.

When the lower bar has been completed, it is placed in its position on the cast, together with the upper bar, or continuous clasp, and the connecting struts constructed. In no case should we ever connect the upper bar to the lower bar with a straight piece of metal, as this will invite disaster. If we examine the gingival margins of the teeth around the cuspids, or the bicuspids, we will see that there is quite a bulge, just below the gingival margin, and if a straight piece of metal is used, and the plate should settle, the connecting piece will be driven into the tissue, developing a sore spot which cannot be corrected without reconstructing the piece, as we cannot grind the connecting piece without weakening it materially.

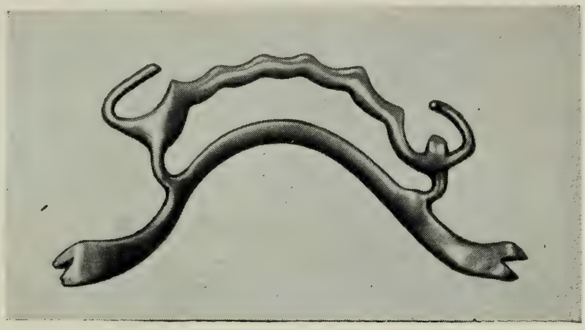

Fig. 330. Continuous clasp and lingual bar united correctly, the connecting attachments being curved.

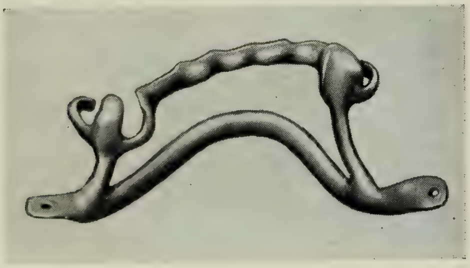

Fig. 331. Continuous clasp and lingual bar united incorrectly, the attachments being straight.

My connecting pieces are made of 14 gauge, round wire, which is bent upon itself to form a semi-circle. (Fig. 330.) This semicircular wire is placed in position between the upper and the lower bars in such a way, that it will not impinge upon the bulging portion of the gum just below the gingiva. I try to leave at least 1 mm. of space between.

This curved wire has the added advantage of acting as a stress breaker. Fig. 331 shows a case which was not constructed in this manner and the connecting wire caused the stripping of the gum and the peridental membrane from a perfectly sound cuspid tooth, with the ultimate loss of the tooth. This piece was constructed by myself and I have kept it in my demonstration kit to show what not to do. One lesson of this kind was enough for me, because when the cuspid was lost, I had to attach to the lateral incisor which, at best, is an unsatisfactory tooth for a retaining attachment. The curved wire has the added advantage of making a nice finish for rubber and feels good to the tongue.

In placing the curved connecting wire in position, the tooth that we intend to use on the case at this point, should be placed upon the cast, articulated and held with sticky wax, to see that the curved wire does not interfere with the placing of the tooth, or that it is not placed so far lingually as to interfere with the tongue.

Investing Continuous Clasp.

When we have the parts assembled with sticky wax, remembering to have loosened the clasp before we have applied the sticky wax, we lift the piece from the cast and we are ready for investing.

It is advisable at this time to see that the joints between the assembled pieces are covered with sticky wax, so that when this burns out, in the investment, the solder will flow in. It is always necessary to flow some sticky wax upon the joints on the side which is against the cast, as this part could not be reached in assembling. This is a principle of soldering in any piece of prosthetic work; that joints between metal pieces which are to rest against investment, should always be covered with a thin film of sticky wax, to prevent the investment from flowing into the joint thus preventing perfect soldering, and also to allow a little air space in the investment which is formed when the sticky wax is melted out. This air space becomes superheated and the solder flows in. If a little excess of solder flows in, it can readily be ground off before putting it back on the cast.

In soldering these pieces, I would advise the use of any standard investment material, but I think it is necessary to have litle wire boxes of different shapes, to strengthen our investments. (Fig. 332.) Make them of iron cellar window wire, which has a mesh of about 3/8 of an inch, and bend it to form boxes in which to do the investing. I have seen many a fine piece ruined due to the cracking of the investment, or to the dentist dropping it on the bench and breaking it. Neither of these accidents happen when the investment is supported. The wire I suggest above is used, because it gives the investment a chance to dry out more readily.

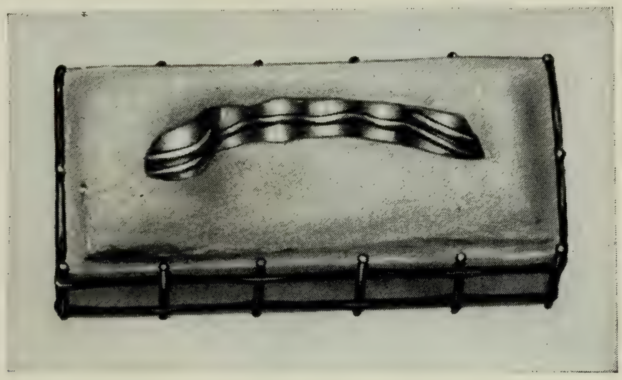

Fig. 332. Investment stage in continuous clasp construction. The investment material is strengthened with an iron mesh boxing. Note that the parts to be soldered are freely exposed for the sweep of the blow-pipe flame.

In investing, do not invest the piece too low in the box. A half an inch of investment should be left between the lowest part of the piece and the box. We should never invest so that we would be compelled to make a hole in the investment to reach the piece, as it will be practically impossible to get the full heat of the blowpipe on the solder if we are soldering in a hole. We should study our investment so that we will have a free sweep of the flame and only use enough investment material to hold the parts together and just cover the edges of the metal to prevent burning. The more the surface of the gold is exposed, the quicker the heating and the easier the soldering (Fig. 332) but likewise, the investment should be bulky enough to prevent warpage. It should not be excessively thick in some parts and excessively thin in others.

After the piece is invested, the investment hardened and trimmed, so that the flame can reach all portions of gold to be soldered, (Fig. 332) the sticky wax is melted out with boiling water. This is best done by having a small cup, with a spout which comes to a fine point, about 1 mm. in width at the opening. The hot water coming through this fine opening gives it a force which more readily washes the wax out of the investment.

The piece in the investment should be fluxed and if necessary antiflux should be applied where we do not want the solder to flow. It is then heated over a gas flame, never directly in the flame, but a hot plate should be placed between the investment and the flame. The heating should be done slowly at first, and as the steam disappears, more rapidly. It can be very nicely done in an electric drying oven which has a rheostat on it for raising the temperature. It is very accurate in the results obtained, eliminating guess work. The thermometer tells us the exact temperature of the investment.

In my office the parts are soldered with Ney's B-4 casting gold. In the period since I have been using this, I have had no fractures of the double bars. Previous to this time, when I used 18 karat solder, I had a number of them break.

After we have finished soldering, remove the investment, grind any surplus solder away and polish. After the clasps have been properly adjusted to the cast, the piece should be heat treated. It should be placed in an electric furnace, or an improvised oven made by wrapping a tin can with asbestos, with a thermometer projecting through and placed upon the fire. The temperature should be raised to 450° centigrade and allowed to cool slowly to 250° centigrade. This will take about a half hour in the electric oven, but it is worth while doing this, because it increases the tensile strength almost one-third.

CHAPTER XXIV

The Application of Cast Clasps in Partial Denture Construction

The cast clasp should have a very limited use in partial denture construction. In my practice I use it only in those Class III cases suitable for the Nesbett bridge, which is constructed without a saddle; in cases where we are clasping crowns, either of gold or porcelain; and, in some rare instances, upon natural teeth which are short and conical, and require a rigid clasp. I have in mind those cases where we are compelled to use third molars, the clasps acting more as supports than retaining devices. Some men maintain that a cast clasp can be made as thin as a wrought clasp with equal flexibility. I have never seen one, and I have the assurance of some of the best metalurgists that the tensile strength of the best cast clasp is between one-third and one-half of that of a wrought clasp of the same cross section thickness.

Cast clasps have the disadvantage of not being adjustable in an up and down direction, and away from and towards the gingiva. It is true that they can be tightened, but if this is done, the molecules of the metal will readjust themselves and they will resume their original form. They are generally rough on the inner surface and if polished sufficiently, they will not fit accurately. They should never be used with an extension saddle unless a stress breaker is interposed.

When we require rigidity, as in the Nesbett type of bridgework, we must use no saddle. Dr. Nesbett has emphatically stated this. While there is sufficient spring in the cast clasp to allow it to go over the height of contour and hold the piece firmly in place, such clasps are not sufficiently flexible to compensate for the movement of the saddle, which is bound to take place under stress of mastication. As soon as the strain is removed, the gum springs back to its normal position, moving the clasp. If the clasp is flexible, like the Gillett clasp, little injury results, but if it is rigid, friction may cause great injury to the tooth. I do not believe cast clasps should be used on natural teeth to support pieces supplying more than two teeth.

Technique for Cast Clasps.

In making the cast clasp, I prefer to obtain a separate cast of the tooth and construct the clasp upon it, and then obtain the relationship of this clasp to the rest of the denture by means of a plaster impression. There are difficulties in this method, but when we use cast clasps, we must obtain a very accurate relationship impression, as cast clasps are not adjustable in an up and down direction.

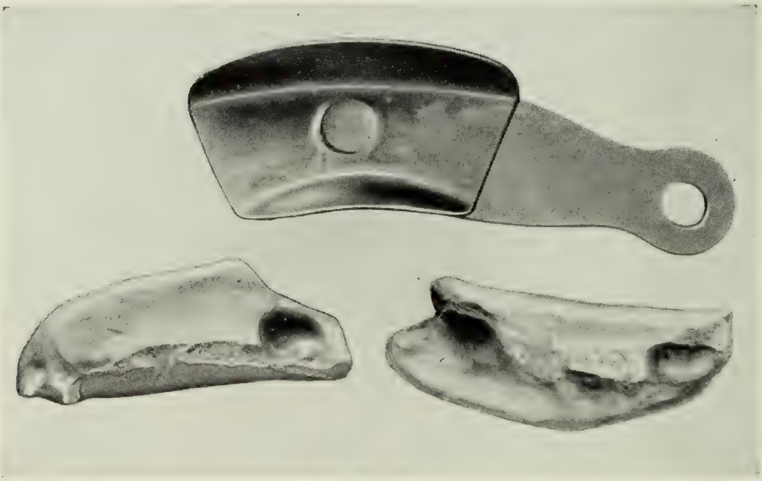

Fig. 333. Impression split and removed from the tray.

The method which I use for making a cast clasp, (except in that type of cases known as the Nesbett bridge and then I follow Dr. Nesbett's technique)* is as follows:

Take a small bridge impression tray and coat it with cocoa butter. In this place plaster, or complaster which latter is a dissolving plaster, readily soluble in hot water, and take an impression of the tooth. When it is thoroughly hardened, the tray is removed, the cocoa butter permitting this, and the impression is sectioned with a knife. (Fig. 333.) It is assembled and boxed with moldine, the moldine being placed in the impressions of the adjoining teeth of which we do not care to obtain a cast.

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*Outlined in September, 1922 issue of the *Items of Interest.*

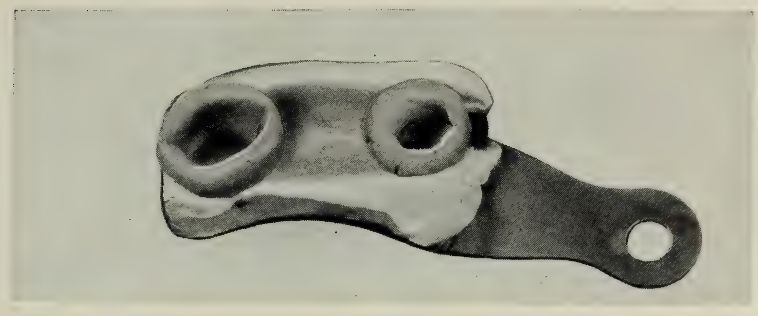

Fig. 334. Impression in tray, and boxed with moldine around the teeth that are to be cast in fusible metal.

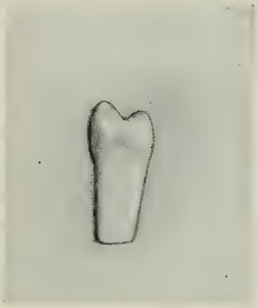

Fig. 335. Fusible metal tooth with root made conical and polished.

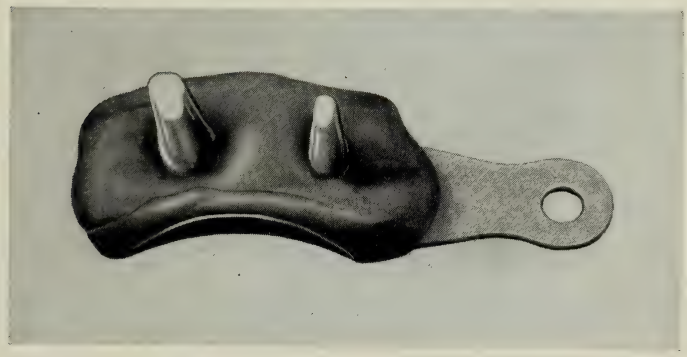

Fig. 336. Modelling compound impression with fusible metal teeth in place.

The moldine is so built as to allow us to form a bucket (Fig. 334) in which the impression of the tooth will be at the bottom. Into this fusible metal is poured. It is advisable, first to dry the impression before pouring the fusible metal. This drying can be done in an electric furnace at a low heat, over a radiator, or in a small tin-can furnace which is heated by an electric bulb. It is best not to have the impression hot, when we pour the fusible metal, the only purpose of the heating being to dry off moisture which might cause bubbles. If a low heat fusible metal is used, this precaution is not necessary.

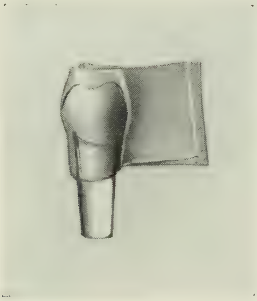

Fig. 337. Fusible metal tooth removed from cast, and wrapped with Ransom and Randolph thin base plate wax.

I have used fusible metals which melt much below the boiling point of water. I prefer to use the Dee metal, low fusing B, which seems to give a very accurate cast. The impression is boxed with moldine and this metal is poured into the impression and when it is hardened, the impression is carefully separated and laid aside. In case of emergency, we can use it again for constructing another cast. Do not make too large a boxing of the moldine as it it wasteful of the metal and if we wish to place the fusible metal teeth in an impression made of modeling compound, large bases are hard to handle. If we intend to take a relationship impression after our cast clasp is made, this is not of so much importance.

Some men, however, make these fusible metal teeth and shape the base with a vulcanite file, conical in form and polish. (Fig. 335.) Then they obtain a modeling compound impression of the mouth in sections, and before pouring the stone cast, place the fusible metal teeth in position in the impression, (Fig. 336) pouring the stone over them. If this is done neatly, they can be removed from the stone cast for waxing, provided we have taken the precaution to polish and oil the base of the fusible metal cast.

Technique for Wax Patterns of Clasps.

After I have obtained my fusible metal cast, I outline the location of the clasp with an indelible pencil, comparing it with my study cast, to see that my outline is in the proper position.

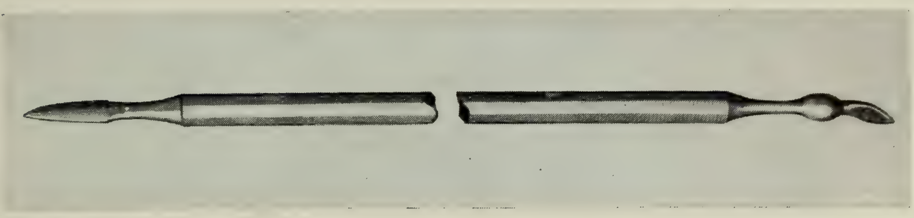

Fig. 338. Roach waxing and carving instrument. Shown here in two parts, but it is a double ended tool.

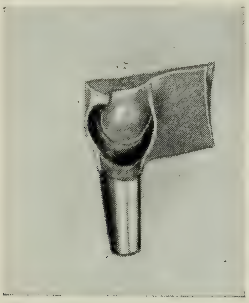

Fig. 339. Pattern of clasp carved to shape; part of base plate wax left until the last part of the operation, and cut away after sprue is attached.

The outline of the clasp is oiled with a thin film of oil applied with a toothpick. As small a quantity of oil as possible is used, and care should be taken not to get the oil beyond the outline of the clasp, as in that case it will be impossible to make the base plate wax, (used in the next operation), adhere.

When this is done, a piece of Ransom and Randolph base plate wax, gauge 30 is wrapped around the crown of the tooth and sealed with a spatula so that it will not move from position. (Fig. 337.)

The indelible pencil outline which shows through the wax is covered with a thin film of green casting wax. I use Mave's wax as it has considerable spring when thoroughly chilled, and is not easily destroyed. I also apply it with a Roach waxing instrument. (Fig. 338.) After applying the casting wax, it is carved and smoothed to the shape we want the clasp to be, and then finally smoothed with chloroform which should be thoroughly washed off with soap and water, or our investment will not come out with a smooth surface.

Next, with the sharp end of the Roach carving tool we cut the clasp loose from the base plate wax, leaving a small ring of the base plate wax encircling the tooth until the very last part of the operation. (Fig. 339.) That portion of the base plate wax, which lies between the wings of the clasp and covers that portion of the tooth which is not covered with the outline, is removed at the last operation. In fact, I prefer not to remove this until I have attached the sprue. We will find that because we have oiled the clasp outline, we can readily tease the wax pattern off of the fusible metal cast, after attaching the sprue (Fig. 340) and we are ready for investing.

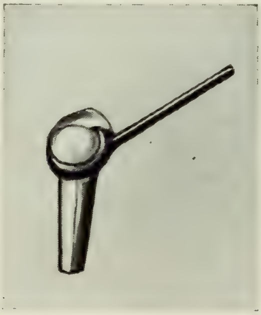

Fig. 340. Wax pattern of clasp on fusible metal tooth, trimmed free of excess base plate wax, sprue attached, and ready to be removed from metalic tooth and invested.

If we examine the wax pattern carefully, we will see that we have a smooth interior, as we started with a smooth base plate wax, and strengthened this with the green inlay wax. Placing the sprue in a crucible former, we proceed to invest. The sprue should be tapering. I prefer not to use phonograph needles, as the wax pattern very often slips off them. It is best to have some sprue formers made which taper gradually to within a half millimeter of the end, but with the end made parallel, as it gives a better hold in the wax, if the sides are parallel instead of tapering. The sprue wire used should not be of iron as it will rust. I sometimes use a small round bur with the head cut off. These burs can be thrown out before they become rusted. (Fig. 340.)

Techniques for Casting Clasps.

The method of investing, burning out and casting is the same as for saddles, and I will describe that in the following chapter. We proceed with our casting and when we have removed the casting from the investment, it is boiled in acid, dressed down with small stones and sandpaper disks, and finally polished. I prefer not to grind the inside of the clasp but a polish is obtained by means of a revolving burnisher in the dental engine. The clasp is now ready to place upon the tooth and to obtain our relationship to the denture.

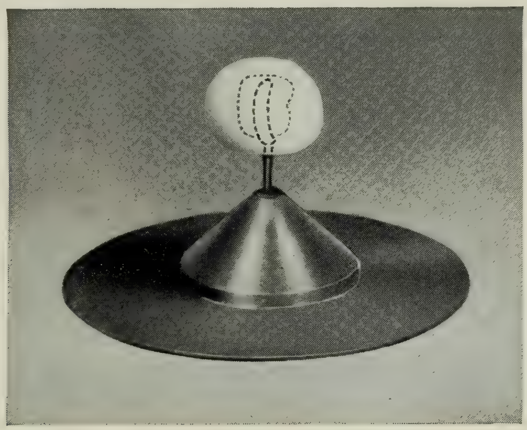

Fig. 341. Wax pattern of clasp made on tooth of cast poured with investment. The tooth is cut from the cast, sprue attached to wax, and a primary investment is painted over tooth and pattern of clasp.

Another method of making a cast clasp is to construct it upon a cast of inlay investment material. This is more difficult than the preceding method, and great accuracy and delicacy must be observed in handling the cast after it is made.

It is possible to obtain our impressions in plaster or complaster, but we are liable to mar the investment cast when we separate the plaster impression from it, and if we use complaster, we must be very careful in the boiling out as it materially weakens the investment cast. It can be done nicely, however, by taking a sectional modeling compound impression and pouring a hard grade of investment material. After this has thoroughly set, we carefully heat the compound and remove it from the investment cast, and outline the clasp.

If the cast is dry, we can cover the outline in green casting wax from a spatula. Care should be taken not to get it beyond the edge of the outline. The wax is scraped to shape with a sharp instrument and smoothed with the very least bit of chloroform on a pledget of cotton.

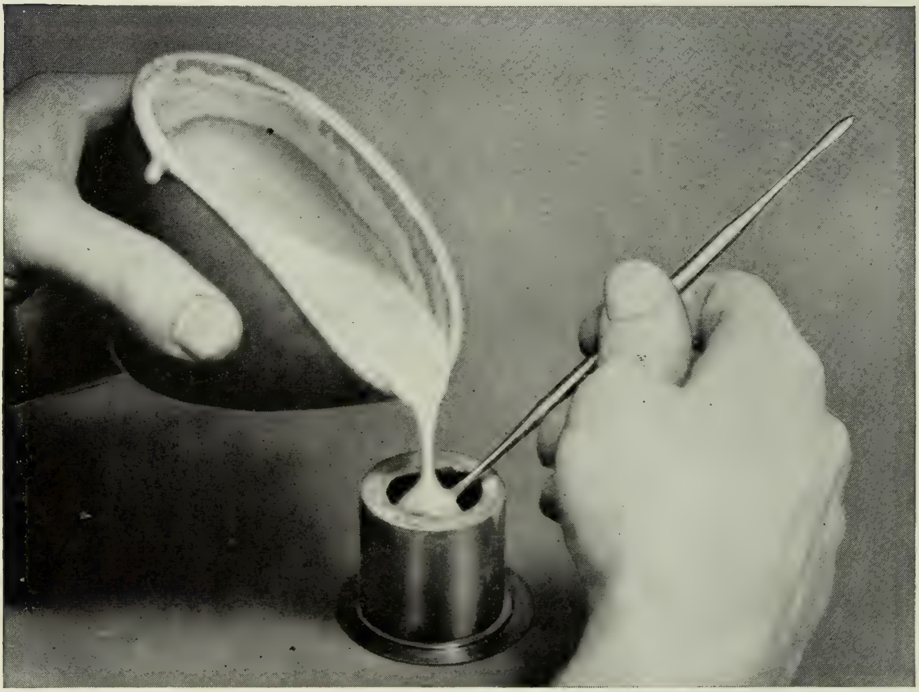

Fig. 342. Ring placed upon crucible former and secondary investment poured into ring and around primary investment.

There is danger in using chloroform, however, and it is best to try to shape the wax entirely with a sharp instrument. The sprue is stuck into the wax pattern and in this instance the wax pattern is not removed from the cast, but is invested in the inlay ring with the cast of the tooth. (Fig. 341.) In preparing the cast, it should be made as small as possible and still allow us to handle it, or we would need to use a large inlay ring which would take a long time to burn out.

After the sprue has been stuck into the wax, we dip the cast in water for a short time, so that when we apply new investment, it will adhere to the cast and not separate and allow a space which would form feathers on the casting. In flasking these, I prefer using two mixes of investment, painting the investment upon the wax and the original cast with a camel's hair brush, but not rubbing it back and forth, because if we do this, air bubbles will form, producing an imperfect casting.

It is best to dip a brush into the soft investment, picking up an excess of investment and applying to all parts of the wax, forming a ball of investment around the sprue former. (Fig. 341.) When this is hardened, we can mix another batch of investment to fill the ring, (Fig. 342), (of course first having attached the sprue to a crucible former), and proceed with the casting.

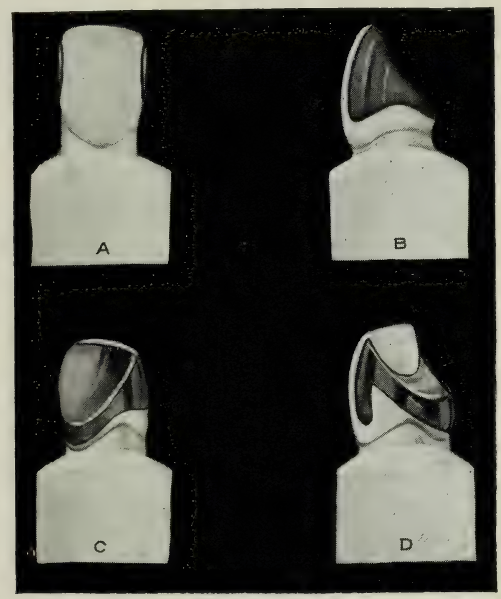

Fig. 343. Roach mesiodistal grip clasp, made by the casting process. A, B, and C, labial and lingual views. D. Modification for close bite cases.

Mesiodistal Grip Clasp.

There is another type of clasp which is useful in many cases, known as the mesiodistal grip clasp. (Fig. 343.) I have mentioned this under the heading of wrought clasps. Dr. Roach makes such clasps by the casting process and he has kindly allowed me to use the illustrations of his original article read before the Illinois State Dental Society and published in the *Journal of the National Dental Association*, 1919. These are made by the technique described above, of pouring an investment cast in either a sectional modeling compound impression, or a sectional complaster impression, and constructing the clasp immediately upon the cast.

Continuous Loop Clasp.

Dr. Roach has developed a continuous loop clasp of various forms for molars as shown in Fig. 344. These clasps are very useful, especially where the molars are rotated. They are made by a combination of a casting with wrought wire.

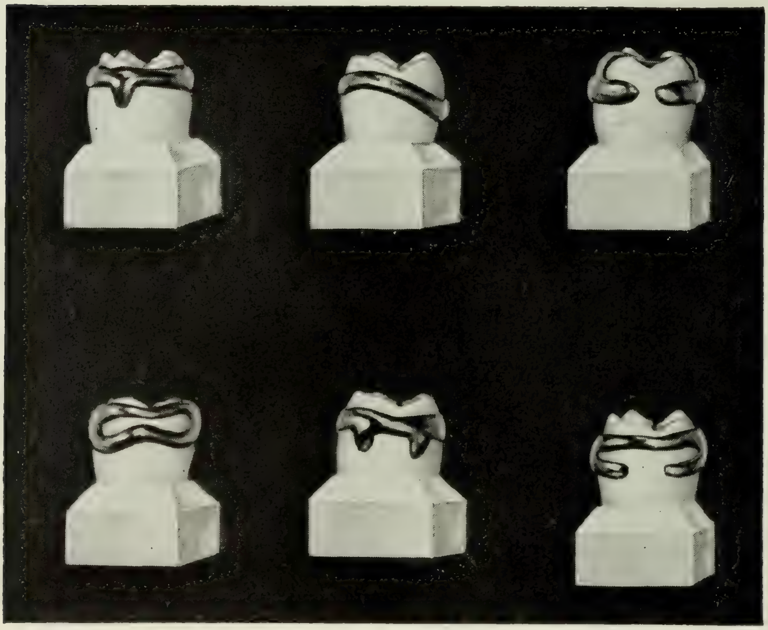

Fig. 344. Roach continuous grip clasp for molars.

One-Piece Denture Casting.

Much has been said in the last few years about one-piece denture casting and many men have claimed originality for the technique. Due to extensive advertising many dentists are being led to adopt this method, but I believe from my own experience and that of Dr. Nesbett, that as great damage will be done by extensive pieces made after this manner as has been done with fixed bridgework.

There is a small field for this type of work just as there is for the Nesbett type. One of these places is where we are supplying a single molar tooth. This was described in a paper by Dr. Roach published in the *Journal of the National Dental Association,* in 1919. I can find no previous literature relating to this type of work. Roach made his cast of inlay investment material.

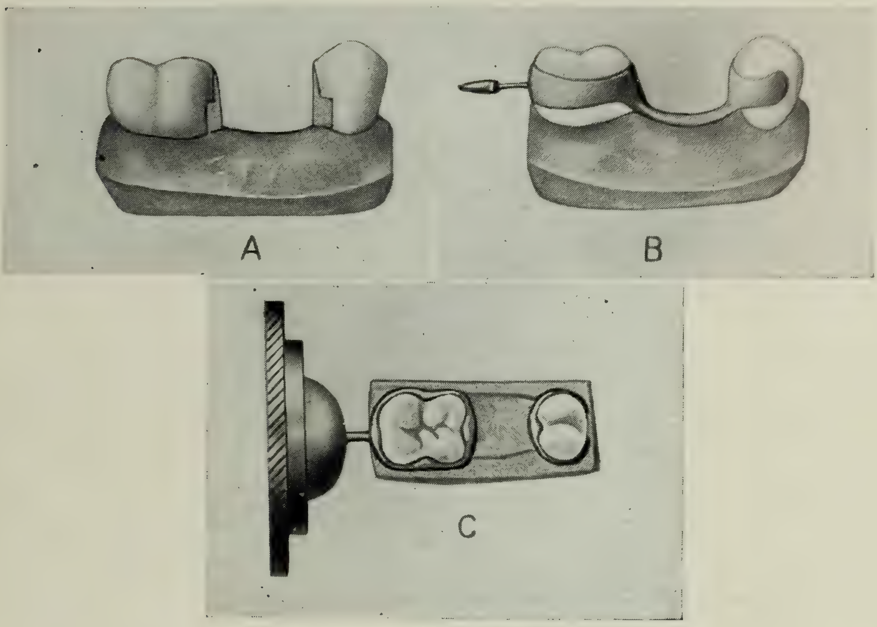

Fig. 345. Technique for short span bridge cast in one piece. A. Cast with dovetailed notches cut at gingival margins and fresh plaster added to produce parallel surfaces on distal side of bicuspid and mesial side of molar. B. The bridge with two clasps waxed up. Note continuous clasp around molar, and attachment of sprue to distal surface of molar clasp. C. Cast and pattern of bridge ready for investment.

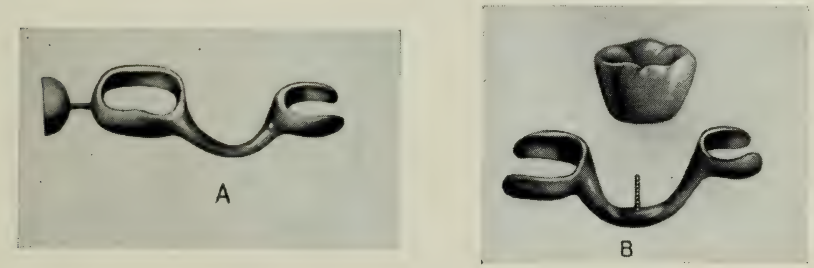

Fig. 346. Bridge shown in Fig. 345, after casting. A. Casting unaltered. B. Distal part of molar clasp cut away, and post added for retaining artificial tooth.

Roach's One-Piece Cast Denture.

"After a model has been obtained it will be necessary to build up the mesial and distal gingival concavities of the molar and premolar so as to make them a straight line occluso-gingivally, because we intend to cast the clasps and the saddle in one piece. Any one will realize that it would be absolutely impossible to place a cast saddle with two clasps in the proper position, unless some means have been taken to pass the mesial and distal convexities of the molar and premolar. After the model has been treated as shown* in Fig. 345 A; then the bucco-lingual clasps and the saddle are waxed up on the model as shown in Fig. 345 B. It will be noticed that the wax on the molar extends entirely around that tooth making a complete ring, because the sprue for casting is placed in the distal surface of the wax pattern that encircles the molar. Fig. 345 C, shows the occlusal view of the saddle and the clasp, waxed up preparatory to investing for casting. Fig. 346 A shows the bucco-lingual cast clasp on the molar, to which the saddle has been cast in one piece, as a continuous ring which extends around the molar. Fig. 346 B shows the distal portion of the ring which was cast around the molar cut away, which now gives us two bucco-lingual cast clasps, one for the molar and one for the premolar, and the cast saddle. To the cast saddle has been soldered the post which is to support the porcelain tooth, which replaces the missing tooth. The construction of the

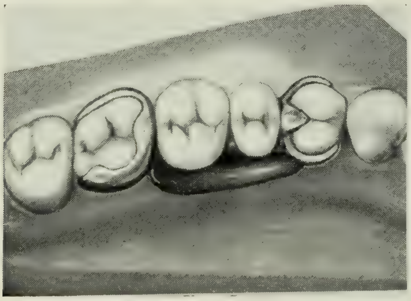

Fig. 347. Shows Tuttle clasp on molar. Note lip over lapping into lingual groove.

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*As molars and bicuspids are narrower at the gingival area than at the height of contour, Dr. Roach cuts out a dovetailed pocket at the gingival approximal area of the tooth to be clasped, which dovetail serves to retain plaster which is built into and against these teeth in order to produce occluso-gingival straight lines. (Fig. 345 A.) A clasp denture fitted against the teeth so altered will "draw."—Editor.

cast clasp and saddle shown in Fig. 346 is such that the clasps grip the buccal and lingual occlusal constriction of the molar and premolar, and thereby support considerable of the stresses of mastication and relieve the pressure of the saddle on the soft tissue."

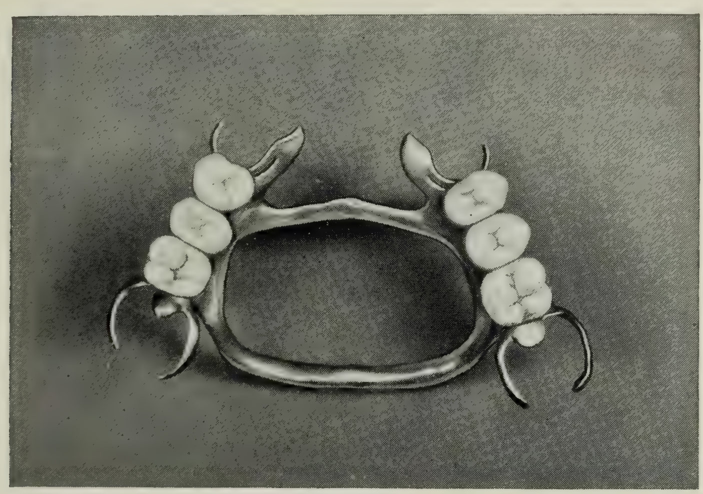

Fig. 348. Skeleton denture showing method of clasping cuspid porcelain jacket crowns. The clasps are of wire, attached to extensions constructed to give additional spring to the short wire clasps, which do not show labially. The molar clasps engage gold crowns

The Tuttle Cast Clasp.

A very useful clasp is known as the Tuttle clasp, designed by Dr. Tuttle of Brooklyn. This clasp is useful where it is inadvisable, or impossible, to grind a seat for a resting lug on the mesial side of a molar, or the distal side of a bicuspid, due to an extremely close bite, or where the teeth are badly abraded on the occlusal surface. Dr. Tuttle extends the clasp into the buccal and lingual groove on molars, and, if the tooth is malposed, it does not interfere with occlusion. He places his support at any point that offers a good opening. An example of this clasp is shown in Fig. 347.

I sometimes make an encircling clasp to entirely surround a conical shaped third molar, but such a clasp does not have any retention grip upon the tooth.

Dr. Ottolengui has consented to describe his use of cast clasps in exceptional places, or under exceptional conditions. His description follows:

Dr. Ottolengui's Use of Cast Clasps. "I am heartily in accord with the author's contention that the cast clasp, as now so commonly used, is a menace to the natural teeth. Nevertheless there are rare cases in which the cast clasp may be our best solution of some difficult problem. Also, it is at times very useful in connection with artificial crowns, where of course there would be no enamel surfaces to invite decay. The following case history describes one case, and may be instructive.

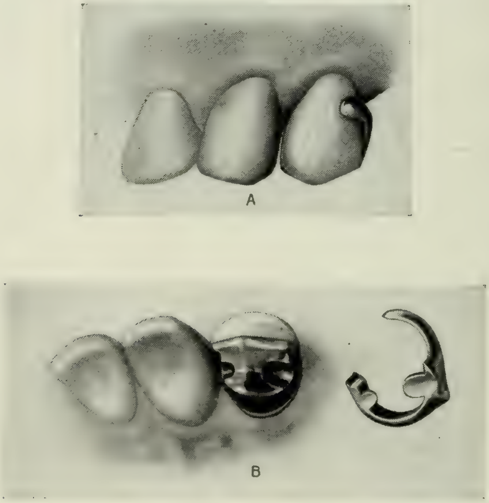

Fig. 349. Cast telescopic clasp suitable for cuspids and short bite cases where the natural crown is replaced with an artificial substitute. A. Shows the labial view of the clasp arm that extends around the crown. B. Delineates the construction of the crown and clasp. The labial part of crown is a Steele facing. The gold backing is carved to have two occlusal rest grooves, and a shoulder at the gingival margin. The cast clasp, seen to the right, fits against the gingival shoulder and the rest lugs complete the occlusal anatomy of the crown.

A Case History. "The patient, a highly sensitive woman, had lost the two maxillary bicuspids and first molar on each side. About eight months before I saw her, she had had two fixed bridges placed. The cuspids and the second molars were perfectly sound teeth. The greater part of the enamel was removed from the molars for the reception of gold shell crowns. The cuspids were similarly treated, but were so extremely sensitive that after grinding, the tooth stumps were very little reduced. For these, porcelain faced gold crowns were made, and because of the incomplete reduction of the labial surfaces of the natural teeth, the new crowns, when placed, were extremely prominent and disfiguring. To these abutment crowns were soldered pontics to fill the spaces. In an endeavor to produce a natural appearance, the casts of the mouth must have been considerably scraped to permit placing the pontics close against the gum. This was accomplished, and the two bridges cemented to place.

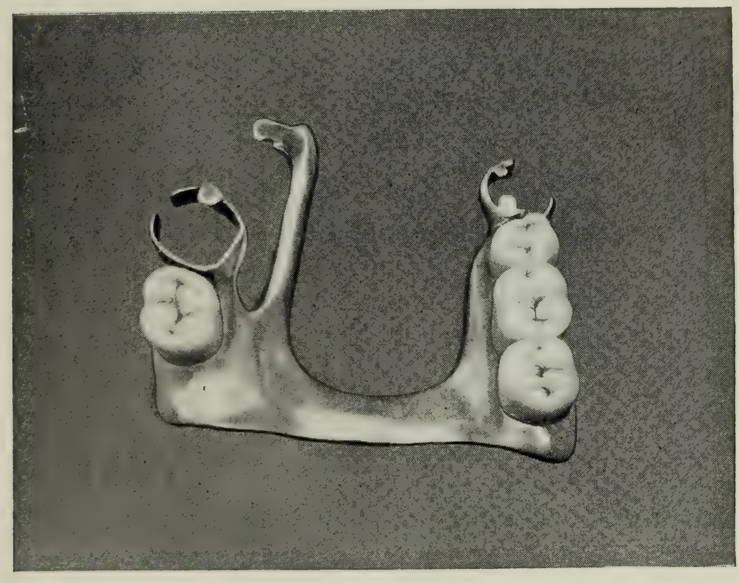

Fig. 350. The denture for which the clasp shown in Fig. 349, was constructed. The molar clasp is a flat plate clasp encircling a gold crown. The long arm, cast with the plate, rests against and between the cuspid and bicuspid and stabilizes the plate.

"When I first saw the patient she not only complained of the ugly appearance of the cuspids, but that her gums were "sore." Examination showed that the pontics had indeed been placed tight against the gums, as hypertrophic tissue was present over all of them at their points of contact with the gums. This resulted in bleeding when cleansing the teeth, and even during mastication of food.

"Whilst not germane to our present subject I might state that this experience teaches that fixed bridgework of this type should be set temporarily for a sufficient length of time to indicate just how closely the pontics may be fitted against the gums without bruising. If the bridge is temporarily set, it can be removed and the gingival ends of the pontics can be ground, in case inflammation of the tissues is observed. But if the bridge is permanently cemented it must be destroyed in the removal.

"I must here state that it would have been my choice to supply this patient with removable bridges of the Chayes type, but for several reasons this seemed inadvisable. The chief obstacle lay in the fact that the cuspids were so dreadfully sensitive, and already so badly mutilated, that there seemed no good way of constructing crowns which would carry the female parts of the Chayes attachments, without display of gold, and to this the patient made absolute objection. It is because this problem was solved satisfactorily without showing any gold, that Dr. Kennedy, who saw the case, has asked for a description of it.

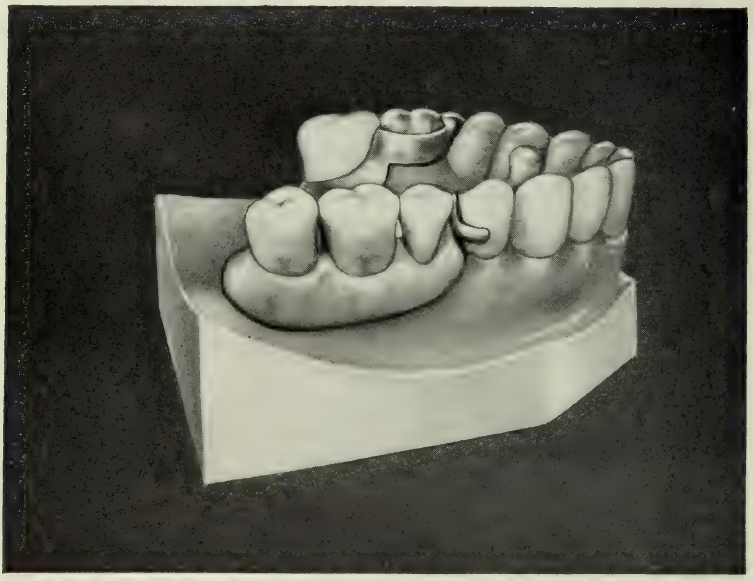

Fig. 351. Same denture as that in Fig. 350. The photographer has given an incomplete view of the extension arm, but the extreme end of it is seen resting against the anterior teeth.

"The finished denture is shown in Fig. 348. The clasps are a combination of wire and cast gold. The molars were completely covered with gold crowns. These were constructed by making platinum bands, contouring with wax, and casting to proper form. The rest lugs were cast. For the cuspids, all-porcelain jacket crowns were constructed, with a considerable gingival recession made in the distal approximal contours.

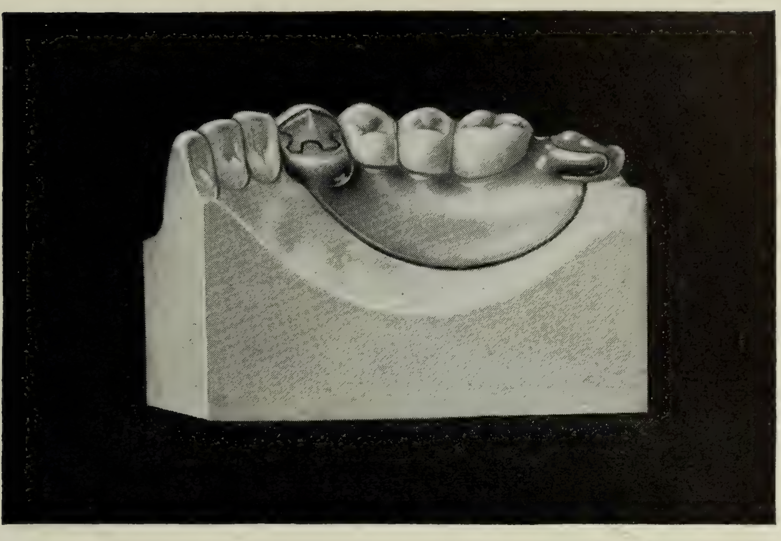

Fig. 352. Another denture in which cast clasps were excusable. The molar cast encircles a gold crown, hence can do no damage. The cuspid is an artificial crown, with telescopic cast clasp, as described in last case. Here the bite is very short, and additional retention was obtained with an extension clasp, as seen in the next illustration.

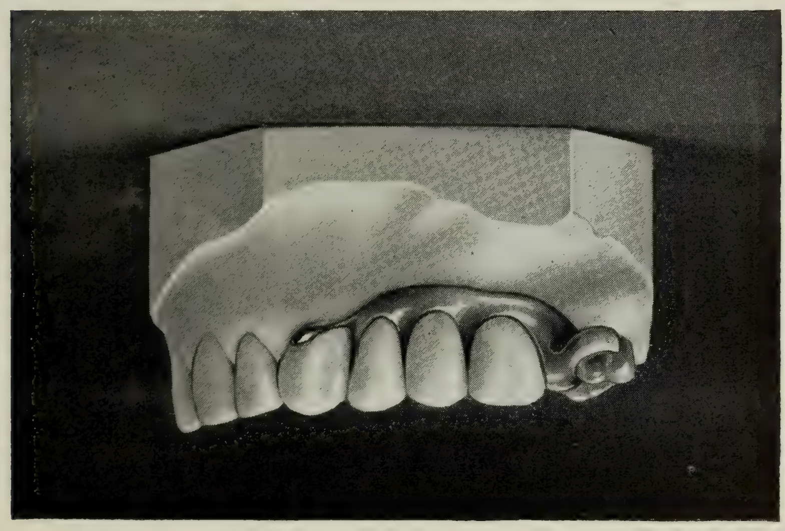

Fig. 353. Buccal view of the denture shown in Fig. 352. A wire clasp with finger form at terminals rests above the labial bulge of the cuspid and aids retention.

Neither one of the wire clasps shown in the illustration would retain a denture, but the two acting in correlation, and springing over the distal contours built on the porcelain jackets, supplied perfect retention. The extensions seen in the region of the lateral incisors (Fig. 348) are not required as extension rests for the structure. Indeed, they do not actually touch the lateral incisors. They were planned for attachment of the wire clasps, so as to leave sufficient length to the clasps to give us resiliency. These wire clasps do not encircle the cuspids sufficiently to reach the labial surfaces, extending into the embrasures far enough for retention, but avoiding display of gold, because only the ends of the wires are seen, and these lie so close to the gum as to be practically invisible. This was a case where the previous work produced a problem, quite different to the one that would have presented, had these four abutment teeth not been stripped of their enamel for the fixed bridge structures.

Telescopic Cast Clasp.

"But the clasp in which I think Dr. Kennedy is most interested is one that I use frequently for cuspids, though the principle is applicable to other teeth. This type of cast clasp is useful where the cuspid is pulpless and must be crowned. A cast base is constructed, and fitted with a Steele facing. The lingual surface is built up as high as the bite will permit, and fashioned at times in the form of a bicuspid, though even in short bite cases (Fig. 352) the principle can be utilized. Fig. 349 B shows the construction of the crown, with two occlusal grooves, and a gingival shoulder. Thus, when complete the clasp is within the circumferential dimension of the tooth. This crown is finished and highly polished. The clasp is then waxed up against the highly polished gold backing, the sprue is placed in the wax pattern, the facing is removed, and the gold crown with wax pattern in place is invested and the casting is made. With careful technique and a mould kept as cold as possible, the clasp can be perfectly cast without adhering to the crown. Such a clasp is shown to the right side of Fig. 349 B, and the labial appearance is seen in Fig. 349 A. An occlusal view of the denture for which this particular crown and telescopic cast clasp was made, is shown in Fig. 350 in which is also seen a stabilizing arm, after Dr. Cummer's plan. This arm was cast with the denture in order to secure accurate adaptation against the natural tooth, as seen in Fig. 351, in which unfortunately the artist has not shown as much of the denture as was desired. However the adaptation of the stabilizing arm can be seen. The other clasp on this denture is of the flat plate type, and encircles a gold crown.

"An adaptation of this principle to cuspids in short bite cases, together with a means of securing greater retention is shown in the next case. Fig. 352 shows the lingual view of a maxillary restoration. The telescopic cast crown for the cuspid is seen, in this case the cuspid not having been built up lingually as high as in Fig. 349. The molar clasp is the ordinary cast clasp, but it is not a menace, because it clasps a gold crown.

"In Fig. 353 we see the labial aspect of the same denture, and here is shown the technique for securing tighter retention. At the extreme upper margin, along the buccal surface of the denture, a clasp of round wire is soldered, long enough to reach the cuspid. Solder is flowed over the extreme mesial end of this wire, and it is then flattened. This gives us an extension finger that can be made to rest against and above the labial convexity of the cuspid. This prevents the denture from slipping downward, and affords a ready means of tightening our clasp, which can be done by slightly bending the wire of the extension finger. It is very inconspicuous, and this particular denture has served its purpose without attention to any of the clasps for three years."

CHAPTER XXV

Cast Saddles and Palatal Bars Technique for Casting

I use a great many cast saddles for all types of cases except those cases which have a great number of modifications. Then it is simpler to swage the saddle. I do not believe that the casting process is as certain as the swaging process but where we are using saddles with palatal bars, as in a Class I upper case, it is quite a simple matter to cast the saddles and the bar in two pieces. In a Class II or Class III upper case, the saddle and the entire bar can be cast in one piece. In Class III, modification I, the saddle and the bar can be cast in two pieces. In a Class IV, upper case, the anterior saddle and the palatal bars can be cast in two or three sections and soldered together. In a Class IV, lower case, the anterior saddle can be cast together with the resting lugs, and the bars can be made of stock material, bent to shape and soldered to it. This makes a very neat appearing cast.

Great progress has been made in the alloys of gold in the last few years and the Bureau of Standards is still working out these problems for us. I do not believe in using the low karat gold, recommended by one-piece casting advocates. I would advise the student to use the high karat golds, as they have proven very satisfactory in my hands and in the hands of many other men. I would strongly advise the student against the theory of one-piece castings, and especially, I would oppose the casting of clasps continuous with the saddles.

I have had enough failures in this type of work to lead me to discard it, and I am credibly informed that in one Dental Base Hospital, they have over 1000 pieces of work which were discarded because of damage to the teeth by the cast clasps, most of which were cast continuously with the saddle, or cast separately and soldered to it.

Where a cast plate becomes bent, it is impossible to bend it back and I have had no success with swaging it back, as I have with constructed pieces. I find that when you bend a casting in one direction, it will spring off in another, and the only way to save these pieces is to cut the saddles loose from the bars, take new impressions and reassemble them. Sometimes it is necessary to recast a part that is bent. This always applies to the cases where shrinkage has taken place. A constructed piece can be reswaged; a cast piece must be made over; partly, if not entirely.

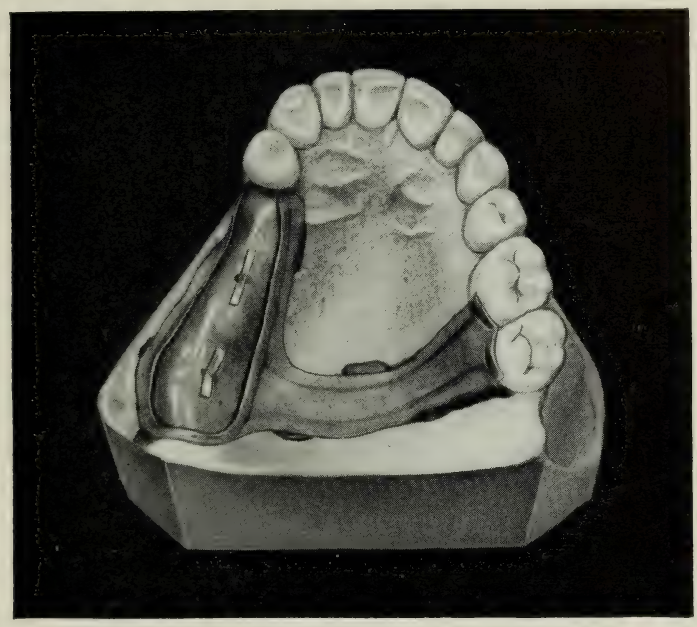

Fig. 354. Wax pattern of saddle on the model. Edge of saddle strengthened with narrow strip, and wax loops in position to hold vulcanite. Bar strengthened with extra piece of wax ready to trim to exact plate outline.

The technique for casting a single saddle with a palatal bar is rather simple. The model is outlined and the saddle area and the bar area between the outline is rubbed with a thin coating of talcum powder to prevent the wax from adhering.

Next a piece of 28 gauge, base plate casting wax is gently warmed and pressed into position on the model. It is trimmed about one-eighth of an inch larger than the plate outline, all around, and sealed with sticky wax. Then the bar is strengthened with another piece of wax, either 28, or 30 gauge. The saddle area is surrounded by a narrow rim of wax to form an edge for the vulcanite. This rim should be about 2 mm. in width. It strengthens the saddle considerably and allows us to have a rounding edge on our saddles. This makes a nice finish if it is carefully done. (Fig. 354.)

Narrow pieces of wax in the form of loops, (Fig. 354) are placed on the saddle within the area where the vulcanite is to be attached. These little loops make good retention for the vulcanite.

Wax Sprue Former Gun.

We are next ready to attach the sprues. They are best made of wax by using a sprue former gun, Fig. 355. This particular gun has been purchased at a supply house, but I formerly had one made out of an old metal syringe, removing the needle from the syringe cap, and boring a hole in it sufficiently large to make the sprue.

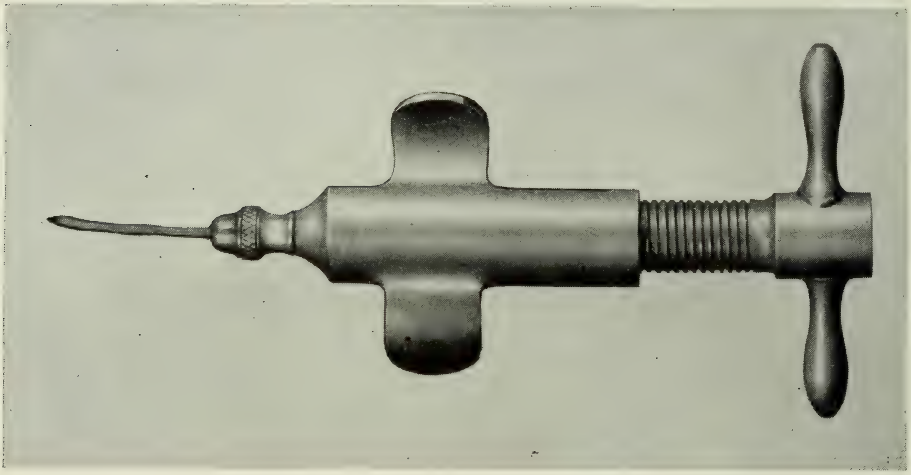

Fig. 355. Wax gun sprue former showing wax being forced out in shape of wire.

After the sprues have been attached and brought together at one point, we can cut the wax to the outline, smoothing the edges, removing the surplus wax from the model and placing the wax saddle back on the cast to see that it has not been distorted.

Two or three sprues can be used for a saddle and can be placed in such a position on the saddle area, that after they are cast, they can be cut off, allowing a little stump to remain as additional retention for the vulcanite. If the sprues are carefully placed, they will give considerable strength to the wax pattern. The sprues are all brought together at one point and they should be of about an equal length. They are then attached to the crucible former, (Fig. 356) and we are ready to invest, after having sprayed the wax with acetone from an ordinary spray bottle. The acetone will remove any fat, or grease, which might have been on the wax, and allows the investment to adhere more closely.

Investment Materials for Casting.

There are numerous standard investment materials on the market. Most of them produce uniform results if care is taken to mix them as directed. It is not a good idea to mix them with very much stirring, as this incorporates a great deal of air. There are several mixing machines, but I think a mortar and pistle produces as good a result as any. Dr. Taggert recommended the mixing of investment by simply jarring the bowl and rotating it. This liberates the air.

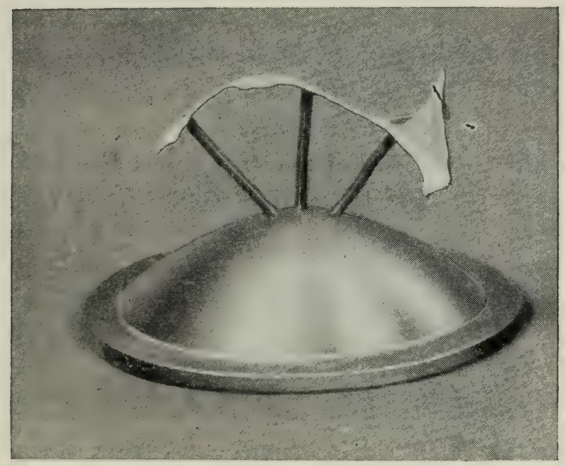

Fig. 356. Sprues in position on wax saddles and attached to crucible former.

When we place the primary investment upon our saddles, it is best to place it on with a spatula, or a camel's hair pencil but do not brush back and forth, as air bubbles in the investment will immediately approach the wax and give us a rough casting. The best way is to start at one end of the saddle with a small quantity of investment, and work forward to the other end, by adidng small instalments of investment with a spatula, or a camel's hair pencil, pushing the excess ahead.

The ring is placed over the partly invested pattern on the crucible, and additional investment material is poured from the bowl down the sides of the ring. (Fig. 342.) It will gradually climb up and unite with the primary investment on the wax pattern. If it is not too thick, this can be done nicely without the danger of disturbing the pattern. If we find that the investment is setting before the ring is completely filled, it is much better to wash out the investment and make a new mix of investment rather than to risk jarring it or forcing it with a spatula or brush. When of proper consistency, however, it should be lightly directed with a brush, or spatula, so that it flows evenly all around the ring.

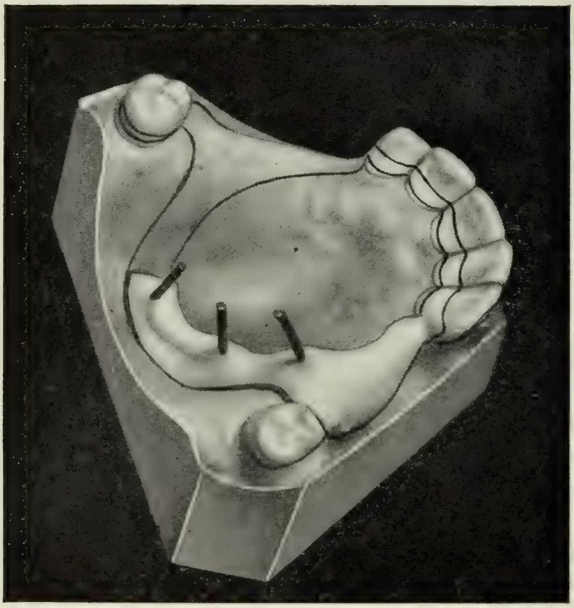

Fig. 357. Showing method of flowing investment on the wax pattern before removing from the model. This is known as the double investment method.

When the investment has taken its initial set, the excess is trimmed from the ring, the crucible former is heated and removed, and the invested pattern is placed in an electric furnace for drying. Directions for casting and drying will be given at the end of this chapter and these directions will equally apply for the castings for clasps.

Double Investment Method.

Some men use the double investment method. They take a fine inlay investment and while the pattern is still upon the model, with the sprues attached to it, they cover the area just inside the outline with investment material, allowing it to harden before lifting it from the cast and then complete the investment with another batch of material as above directed. (Fig. 357.) This is useful when the pattern is very thin or complicated as it prevents distortion during removal from the model.

There are many instances where it is a simple matter to cast the saddles and the resting lugs in one piece, and solder Steele facings, a tube tooth or a crown in place, (Fig. 358), or even to cast a boxing which will carry a tube tooth, or sometimes to cast entire saddles with boxes to carry two, three or four tube teeth. The method is the same whether for one or more teeth.

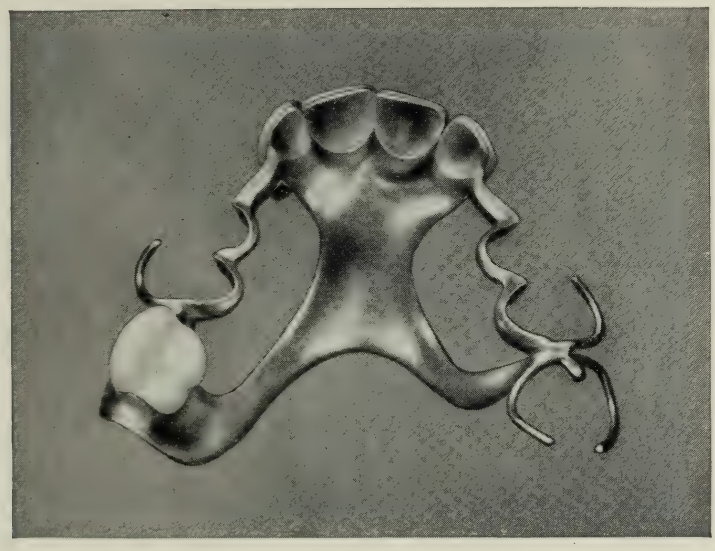

Fig. 358. Showing cast denture with the saddles and the boxing for the molar crown cast in one piece. The fittings for the Steele facings, and the continuous clasps, were built up and soldered to the base.

Casting Boxes For Tube Teeth.

Two thicknesses of base plate wax of 30 gauge, are placed upon the model and carefully smoothed down, and a porcelain crown or tube tooth is selected to fit the bite. When this has been properly done, the occlusal surface is oiled and the tooth indexed with plaster. (Fig. 359.) The plaster covers the occlusal surfaces of the artificial teeth and the adjoining teeth. When this plaster is hardened, the artificial tooth is lifted from the model and the lower edge of it is bevelled to an angle of 45 degrees. (Fig. 360 A.) The approximal sides where it joins the natural teeth are rounded out with an oval depression as shown in Fig. 360 A to allow us to give room for an upright of gold which will carry the lug and the clasps. If there is an adjoining crown, or tube tooth, the same thing is done, but it is not run up to the occlusal surface; only about two-thirds the height of the tooth.

I have found that where I do not run gold between the tube teeth, the patient always complains that fibrous foods stick between the tube teeth, and it is just as uncomfortable as when we have a space between the natural teeth due to the recession of the gums. Where I have not done this, I have been compelled to fill in the spaces with synthetic porcelain, which does not give a very satisfactory finish.

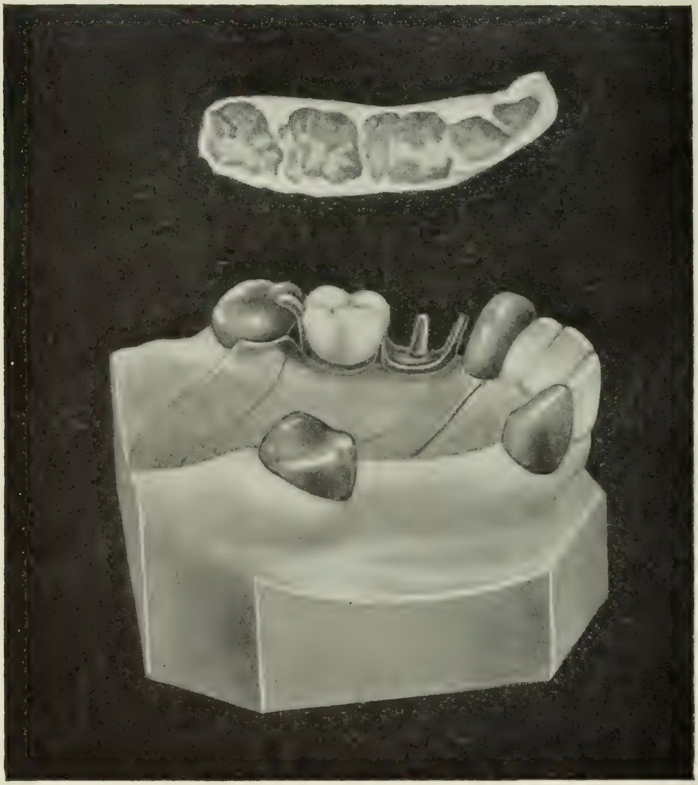

Fig. 359. Double piece of wax placed over the saddle area. Teeth ground and held with plaster core. Index shown above is used to hold the teeth in position while waxing the boxes to the saddle.

When we grind the tube teeth, or porcelain crowns, they should be polished with sandpaper, or cuttle fish disks, and finally polished on the lathe, with oxid of tin.

The pieces of wax that we placed upon the model are now discarded and one thickness of 28 gauge wax is laid carefully on the model, extending about a quarter of an inch beyond the plate outline and waxed firmly to place with a hot spatula, as was done for the simple vulcanite saddle.

The tube tooth, or porcelain crown is lightly oiled with a thin film of oil, and wax is flowed into the hole. If it does not readily enter the hole, a hot pointed instrument can be pushed down, and the wax will flow by capillary attraction. Inlay wax such as the Maves, is warmed gently over the flame, and pressed upon the end and sides of the tooth. It can be made to adhere very closely and while it is still warm, a piece of soft cloth, such as a towel or napkin, is wrapped around it, twisted tight and held until the wax hardens. The cloth is removed and the wax carved to form the boxing. (Fig. 360 B.) The lower ends should be carved very thin, and then placed into position upon the wax pattern of the saddle, and the index of plaster placed upon the tooth, to see that it is in the position we intend it to occupy. If it comes up to our satisfaction, we seal the inlay wax to the base plate wax, and if there is a second tooth, proceed in the same manner with that, sealing it to the base plate wax and also the boxing of the first tooth.

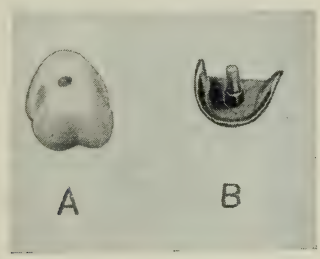

Fig. 360. A. Tooth ground to form for boxing. The larger groove is to make room for upright which supports clasp and rest lug. B. Wax shaped to form boxing.

The resting lugs are then added and care should be taken to oil the model so that the lug will not adhere. The tooth (or teeth) is carefully lifted off from the wax, sprues are placed in position and we are ready to cast. If it is a single tooth, without much of a saddle, we can attach it immediately to our sprue former, and we can invest with one mix of investment; but if it is an extensive saddle, we should better use the double investment method, making a double mix of investment, using one mix to stiffen the saddle, as described for simple saddles in vulcanite work.

Some men make an investment model to make their saddles upon. This method was described under cast clasps, but where we are making a plate with a number of teeth on the saddle, it is practically impossible to obtain a nice occlusion by this method. It is much better to make the saddles upon the working models, and do a double investment. I believe that in point of time in the laboratory, it is about as simple to cast a thin saddle and burnish and swage boxes of pure gold for our teeth, placing a clasp metal pin in the tube hole, and soldering this pin to the pure gold boxing; then assembling the piece and the teeth on the saddles with sticky wax, investing and soldering the boxing to the saddle with a high karat solder. It is about as simple a procedure as that of casting. It has been my experience however, that you cannot convert laboratory technicians to this method. For some reason, they do not care to learn the technique of handling a blowpipe and soldering. Some men, to overcome the contraction of their gold in the boxings, cover their tooth with collodion varnish and wax over this. Others use very thin tin foil, and when the wax pattern is made, place it into the hydrochloric acid to dissolve out the tin foil.

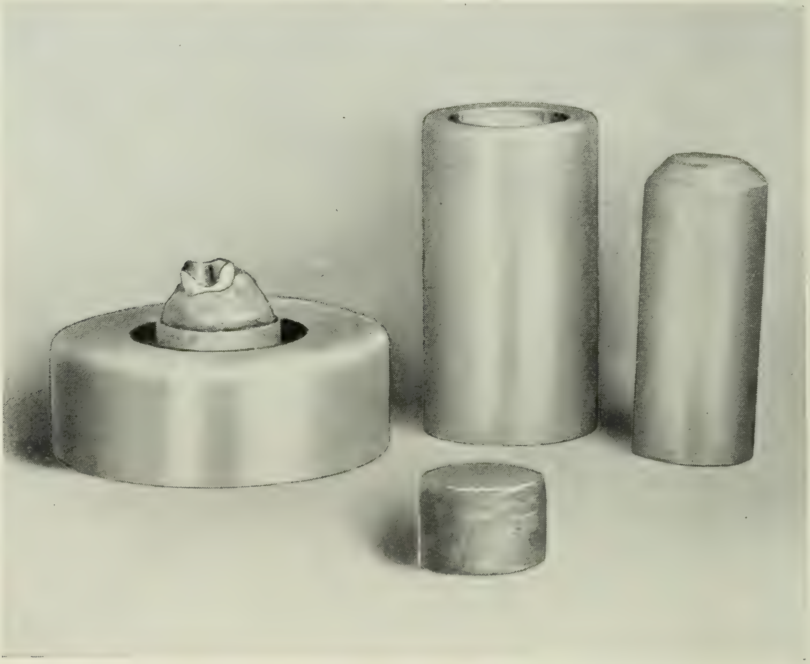

Fig. 361. Tooth placed in a crown swager. Modeling compound holds it to rim. Also showing different parts of the swager.

Swaging Boxes. The swaging of the boxing is a simple matter. The gold is first burnished over the end of the tooth, and up the sides, then the tooth is placed in a small crown swager, such as we use to swage cusp buttons in, and surround it with soft modeling compound. (Fig. 361.) When this is hardened, a roll of soft rubber is placed upon the top of the pure gold, and the swaging ring put into position. The plunger is adjusted in the hole, and with one blow of a hammer, the gold absolutely takes the shape of the tooth. This is lifted from the tooth, the tooth removed from the modeling compound, a hole punched in the center and a piece of clasp metal, round wire, of the proper gauge is placed in the hole in the tube tooth, or crown. It is waxed and a very small amount of wet asbestos fiber is packed around it to fill the boxing, placed on the soldering block and soldered with a high karat solder, using only a small piece. It is then put back upon the tooth to see that it fits. If it does not fit do not swage it, but burnish it to fit, as swaging with the pin in the hole will break the tooth.

The excess of the wire is cut away and ground down so that it will not interfere with the occlusion, and is stiffened with sticky wax. This makes an excellent boxing in combination with casting wax.

If we do not care to solder the box to a saddle which has already been cast, instead of using sticky wax, inlay wax can be used and this boxing placed upon the saddle and gold cast to unite it with the saddle. The pure gold will prevent any roughness, and the tooth is bound to go to place. If the pure gold is allowed to extend about a half a millimeter beyond the wax of the boxing, we will find that we get a beautiful fit when we come to dress it down, as the pure gold burnishes closer to the teeth than any casting possibly could. We likewise do not have to take so much care with the investment, because if a minute air bubble should form within our boxing, which is lined with pure gold, it will not make any difference in the fit as I have never seen the casting gold perforate the pure gold to form a solid ball. Likewise, if we are using wax to fill the hole in the tube tooth, we are compelled to be extremely careful not to bend it when we are investing it, but when we are using a wire of clasp metal, which is much stronger than the cast one, there is not so much danger of getting it out of position. Fig. 358 shows a denture with a cast boxing for the molar. This plate is only roughly ground back of the Steele facings ready for the final finishing with a plug finishing bur. It hardly takes any more time to do this carving, with a plug finishing bur, when the gold is finished, than it does to carve it in wax and cast it. A similar case to this is shown completely finished in Fig. 281. This case was done by the soldering process, and carved out with a plug finishing bur. Some time can be saved, however, where we are using Steele facings, if we obtain the backings manufactured by Grant, which have the lingual surface made upon them. This is of importance, as it assists in articulation of speech and is a great comfort to the tongue.

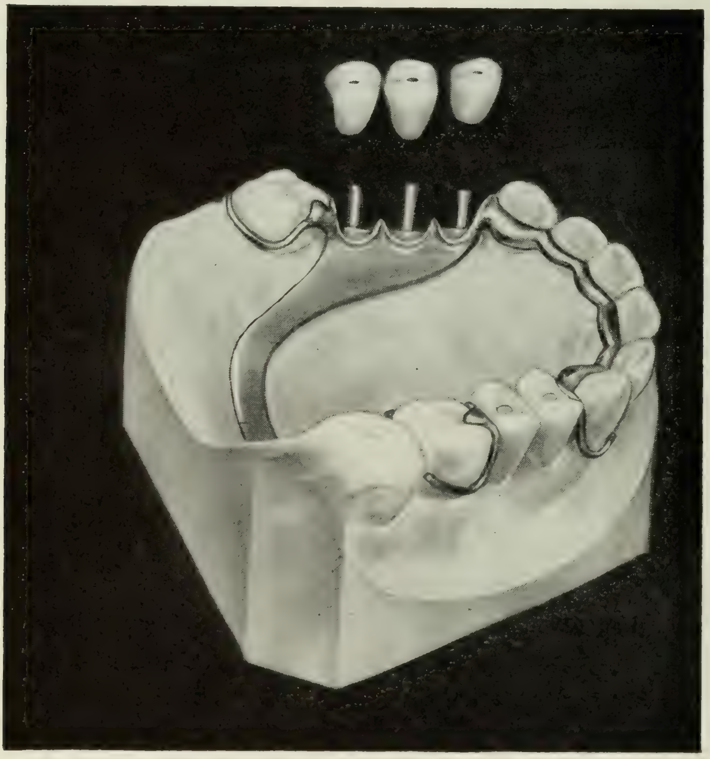

Fig. 362. Saddle and boxings cast in one piece. Teeth raised off to show pins.

It also serves another purpose. If a plain straight backing is used, for an upper anterior tooth, the lower tooth will rise from its socket. If the cingulum is carved, it will prevent this. I have seen ordinary Richmond crowns placed in the mouth where no attention was given to this fact, (that the anatomy was not restored on the lingual side) and in a short time, the crown was forced out of alignment and the lower opposing teeth extruded from their sockets.

Fig. 362 shows a Class II, modification I, upper case with the tube teeth lifted from one side to show the boxings. Fig. 363 shows another view of the same case with the teeth in position.

These saddles and bar were made in two separate castings, and soldered together at the mid line. The anterior continuous clasp was constructed and soldered to the saddle. Likewise, the Gillett clasps which encircle the molar teeth.

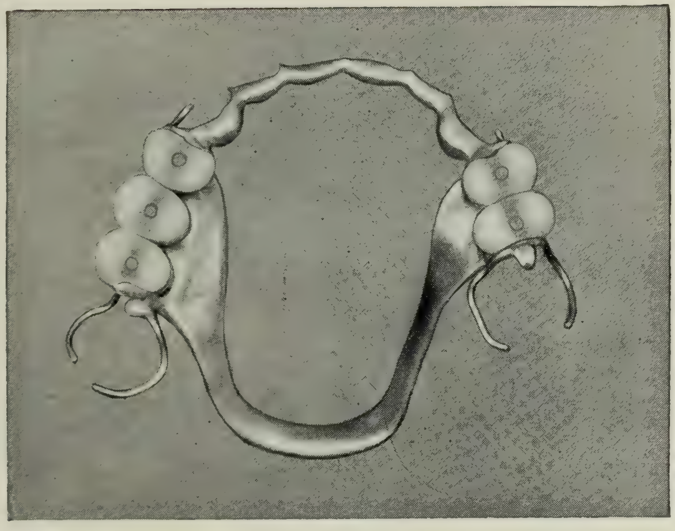

Fig. 363. View of same case (Fig. 362) with teeth in position.

When we are making a casting where a number of pieces are joined together, it is best to finish up one section at a time and wax the next section to it. There are several ways of making the joint. A ninety degree butt joint (Fig. 364 A), should never be made as it is weak, and with the bending of the piece in the mouth under stress of mastication, it is liable to break. I have been in the habit of making step joints as shown in Fig. 364 B, but in soldering these together we are liable to have some distortion. Dr. Engstrom of Los Angeles, has suggested an arrowhead joint, Fig. 364 C, which is very much stronger than the butt joint, but not so strong as the lap joint. He claims this absolutely prevents distortion in soldering, as the length of the joint is over twice that of the ninety degree butt joints.

Do not, however, polish the portion of the joint where we intend to solder, as solder will not adhere to a polished surface. Grind it smooth but use no polishing powder nor rouge or you will meet failure.

There are cases where some ingenuity must be used in designing a cast gold plate, so that there shall not be too much weight. Fig. 365 shows a denture for a surgical case, where the man was injured in an automobile accident and a considerable piece of the alveolar process was lost. He was a teacher in Columbia University, and did considerable talking. A rubber denture was unsuccessful, as he could not enunciate properly with it. I made a very light gold casting, and elevated the Steele facings on small pins. (Fig. 366.) After the work was finished, this was filled in with "Iteco." It made a very light plate and he is using it very successfully today. The posterior saddle and bar extending forward to the anterior saddle, was cast in one piece. The anterior saddle, the backings and the bar on that side were cast in one.

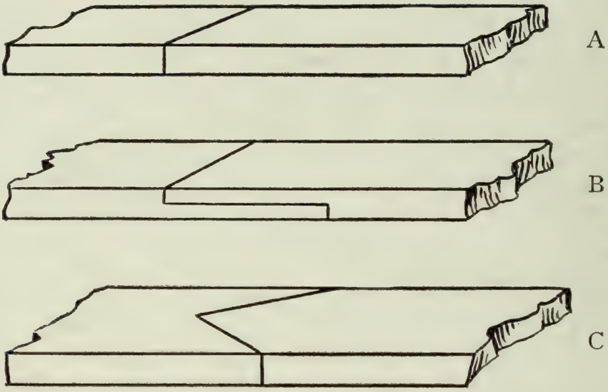

Fig. 364. A. Diagram of butt joint. B. Diagram of step joint. C. Diagram of arrowhead joint, suggested by Dr. Engstrom.

The piece was assembled and soldered with a continuous clasp. This made a very light structure and did not require the devitilization of any of the teeth. There is no gingival pressure. Fig. 366 shows the saddle in progress of construction, with the facings in place before the soldering of the clasps and the continuous bars. Fig. 365 shows the backings in place on the anterior labial aspect, before the application of the "Iteco" or "Porcelite."

Techniques for Casting

It has been my pleasure and profit to take a number of study courses in casting. Dr. Moss of San Francisco obtained as beautiful light castings as any I have ever seen. When I first saw his method, I did not believe that such thin gold would be strong enough, but one of the reasons for his success is the accuracy of each step and the uniformity of his waxing.

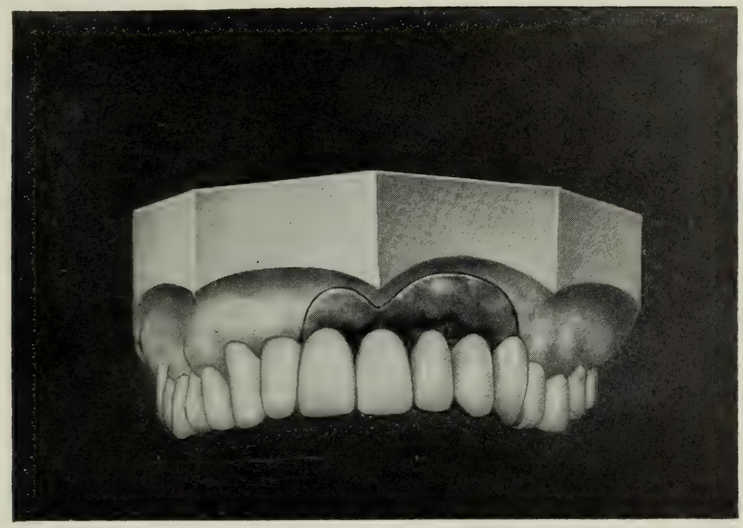

Fig. 365. Surgical case where a large portion of the alveolar process is missing. Labial part of saddle ready for "Iteco" or "Porcelite."

It is a fact recognized among vulcanite workers that if a plate is kept uniform in thickness, it will endure much better than if it were thick at one point and thin at another, and this applies equally to gold. I have been fortunate enough to have Dr. Moss append a few directions as to his method of casting. They are as follows:

Dr. Moss's Casting Method.

"The pattern must be as nearly even in thickness at all points as possible. Gold, in cooling, shrinks towards the thicker mass, and a misfit is the result. A poor pattern cannot be improved by casting in gold, and the final product will depend upon the care and understanding in building the wax.

"The investment of the pattern is another cause for misfits. If the pattern is to be removed from the model by placing investment material upon it, caution is necessary to avoid absorption of moisture from the mixture by the dry cast. That changes the character of the investment, and failure is the result. The choice of investment material is important according to the investment method employed. A low heat investment cannot be used for a red hot mold. The manufacturers have provided investments for all methods. Study them carefully and follow instructions.

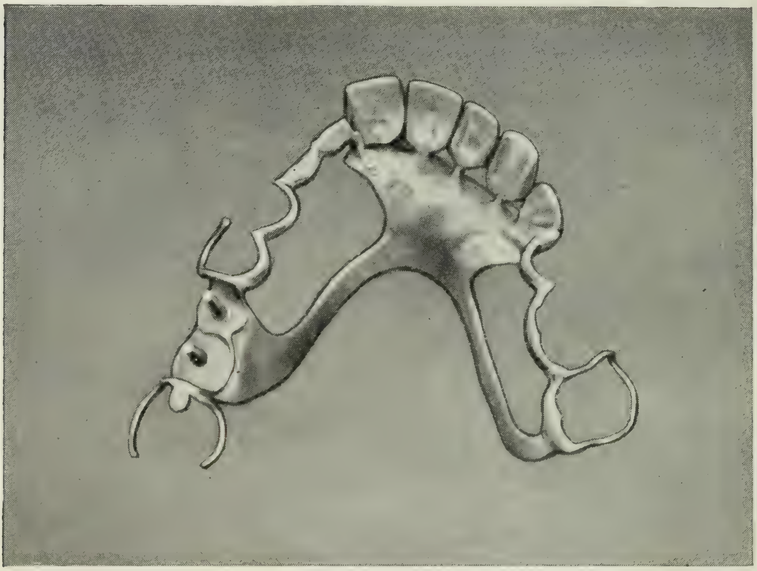

Fig. 366. Lingual view of same case in process of construction. Note the way cast backings are elevated on pins to lighten construction. The spaces will be filled with "Iteco" or "Porcelite."

Low Heat Method of Casting.

"After the investment has been set, moisture should be eliminated in no less than fifteen, or twenty minutes, and longer according to the size of the flask used, and the quantity of wax. Raise the flame but never allow the ring to get red.

"When smoking ceases, and the crucible is still brown, it is ready for casting. If the casting is left to cool in the ring, it will result in a better fit.

High Heat Method of Casting.

"This differs only in the degree of heat applied after the moisture has evaporated. The casting is done while the investment is red hot when looking into the sprue hole. Most of the misfits or failures in castings are due to changes in the wax patterns. The shrinkage of the gold, and standard alloys, is so slight as to be negligible. The choice of gold is very important in thin plate castings. A rigid gold like the 14 per cent. platinized gold, or an alloy of gold and copper rigid enough, is essential.

"Heat treating a case after it is finished and polished further strengthens it.

"The temperatures at which golds melt for our different purposes are given on the envelopes, but we have no means of controlling distortion of castings. The safest rule is to cast immediately when the gold rolls and is fully fluid, and before it boils.

"The fluxing of gold after heating helps to retain the baser metals. Practice only can guide us in heating. The quicker the gold is melted, the less the base metals will burn out.

"Oxygen and gas, or oxygen and hydrogen, for large castings is safest if properly managed. Golds properly heated can be used over and over again with excellent results. Never heat a cast and drop it into the pickling solution. Boil it in an aqueous solution of muriatic acid, as many perfect castings are spoiled by overheating."

Heat Treatment. All castings are greatly improved by heat treatment. The manufacturer's instructions with the latest form of electric oven developed for heat treatment of gold, as prescribed by the Bureau of Standards research supply the following data.

When the thermometer registers 625° F. the actual temperature of the work upon the grid will average 875° F.

The work should be held at 625° F. (thermometer reading) for ten to twenty minutes, depending upon its bulk.

The temperature requirements of the hardening process are sufficiently flexible to allow a variation of as much as 25° F., plus or minus, without appreciable difference in result.

After heat treatment the current should be cut off completely and the work allowed to remain in the oven for fifteen minutes. During this interval the oven will cool gradually to between 400° F. and 425° F., and the work may be removed immediately, or may be permitted to remain in the oven till cold.

CHAPTER XXVI

Technique for Constructed Bars

There are numerous cases where it is better to construct a bar, rather than to cast it, especially where we have heavy bites to contend with. The method of constructing palatal, or lingual bars, is very simple and can be utilized on artificial stone casts.

I outline my bar on the cast and indent the edges of the outline very slightly with a round bur. In this instance I am describing a case which will have vulcanite saddles. The outline for the saddle is also designed, and a piece of No. 7 Ash's tray metal (pewter) is cut and burnished upon the cast, ending where the rubber would begin. It is held in place with sticky wax. Pure gold is burnished upon the cast, or placed in the swaging machine and swaged. It is not necessary to make a die, as a lead pencil rubber can be used to drive it to place. The pure gold should be about 36 gauge, and cut a little wider than the outline; about 1 mm. on each side.

When it is swaged, the pewter marking the saddle outline, causes a raise to be made, and the vulcanite will terminate in a nice clear distinct line and will not curl up after the denture is worn, as it does in those cases where we do not step the gold. Next we cut pieces of flat plate clasp metal, 25 gauge in thickness, and bevel the ends so that they overlap one another, or cut them at 45 degrees. Do not have butt joints, as they are weak. Either have a lap joint or a 45 degree angle joint. One piece can cross the palate and another can be cut to join this and run up into the vulcanite saddle, for strengthening purpose. I generally cut this in Y shaped form, one end running forward to attach to the anterior clasp, and one to the posterior clasp as shown in Fig. 368. The ends of the Y should rest on the pewter and not terminate on the gold. The pure gold terminates about 2 mm. inside of the step. This leaves a space for the rubber to run under and get a good hold.

Holes can be punched in the end of the Y, or the edges may be nicked with a file to help get a hold in the vulcanite. (Fig. 368 C. C.) They are waxed with sticky wax to the pure gold in position on the cast, and invested in a good soldering investment, in a wire box to prevent warpage. This is then soldered with Ney's B-2 casting gold.

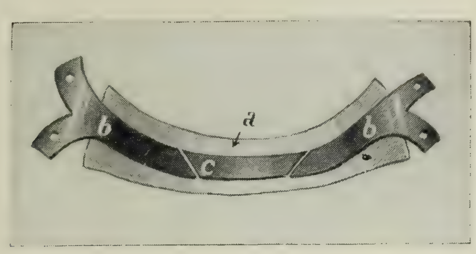

Fig. 367. Constructed palatal bar. A. Pure gold, 30 gauge, swaged or burnished to the model. B. B. Pieces of clasp metal fitted over the pure gold, with ends cut Y shaped to obtain hold in the vulcanite. C. A third piece of clasp metal fitted between B and B, all three cut to form joints at angles of 45°, and soldered to the first strip of burnished pure gold, to strengthen it. Soldered with casting gold.

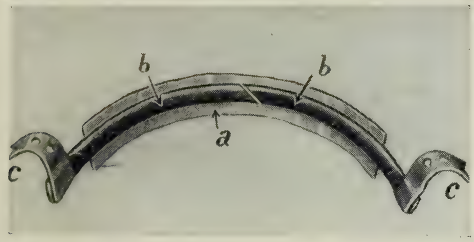

Fig. 368. Constructed bar, for lower denture. A. Pure gold burnished to model as in Fig. 367. B.B. Pieces cut from stock bar, oval, or half round. C.C. Nibs of flat plate, clasp gold, adjusted at right angles to the bar, V shaped at ends, and holes punched. Ends curved to permit vulcanite to flow under.

It is then removed from the investment, trimmed with stones and polished. This makes an excellent bar, and if for any reason the patient bends it, it can be reswaged to fit the original stone cast, without removing the teeth, provided we swage it in a swaging machine, and the teeth are covered with modeling compound to prevent breakage.

Lower bars can be made in the same manner and are very useful where the gum back of the anterior teeth is broad and flat. (Fig. 368.) The ordinary stock bar in these cases is quite bothersome to the tongue. I have several of these broad constructed bars that have been worn for eleven years, and they have just settled into the tissue enough so that the patient does not feel them, and yet they do not seem to irritate.

These bars can be swaged upon fusible metal dies made by taking a plaster impression of the original cast. The impression need only cover the palatal portion of the cast, where the bar crosses it, and should be cut oval in shape, to facilitate boxing, which is done with moldine, or heavy writing paper. The fusible metal is poured into this boxing, and when the die is completed, the surface is coated with whiting, mixed with alcohol to a thin paste, and this die is boxed with moldine, or heavy writing paper, and the counter die poured into it, as in the method of making saddles. This is a very quick and accurate method of swaging these bars.

CHAPTER XXVII

Technique for Constructing Swagged Saddles

There are numerous cases in which it would be about as simple to swage a plate, as to cast one, making much lighter construction for the same strength. Often where there are small extension saddles, the saddles can be swaged on fusible metal dies made directly upon the cast, saving a great deal of time. Also, where we are using the horse-shoe type of plate for our denture, beautiful adaptation can be made by swaging pure gold and strengthening it at the necessary points with a thin piece of clasp metal, terminating this with a thin layer of 22 karat gold, which costruction makes probably the strongest plate possible. The tissues take very kindly to the pure gold, the clasp metal gives it strength, and the 22 karat gold upon the tongue side of the denture maintains a nice color in the mouth without tarnishing. This is not true of 18 karat plates. This also holds good in small lower saddles, and, especially where the ridges are very thin. The saddles can be swaged of pure gold and strengthened with 22 karat gold plate.

In almost all of the Class I, II and III cases, where there are a number of modifications, it is probably better to swage a horseshoe plate, relieving the gingiva with wax, and swaging it so that it runs up to the height of contour on the bicuspids and molars and the basilar ridges of the anterior teeth. For most of those cases, where we have modifications I, II and III, open work dentures can be successfully constructed, and, as the teeth are either of the tube variety, or Steele facings, the plates are best made by the casting process.

I sometimes make a combination of a constructed bar with cast saddles, especially when I want considerable strength in the bar, which applies to both upper and lower bars.

Construction of Dies Without Sand Moulding.

In swaging small saddles it is not at all necessary to make zinc dies and counter-dies, but a ring of moldine can be built just around the saddle area upon the stone cast (Fig. 369 A) and fusible metal can be poured into this ring. This will act as a counter-die (Fig. 369 B) and when it is thoroughly chilled, the surface of the counter-die is coated with a thin solution of alcohol and whiting which evaporates very quickly. It is then wrapped in stiff writing paper held with a string or a rubber band (Fig. 369 C) and the tube of writing paper filled with fusible metal. This will produce the die. (Fig. 369 D.)

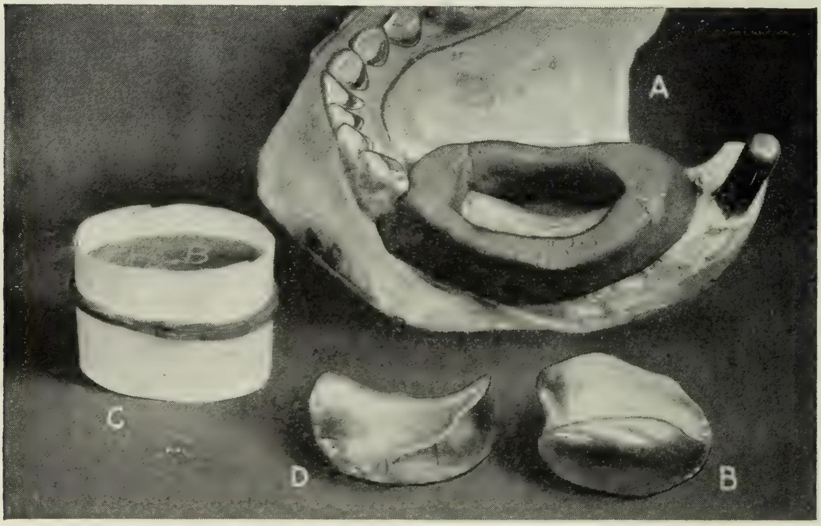

Fig. 369. Technique for swaging small saddles. A. Model with moldine built around saddle area. B. Fusible metal counter-die. C. Counter-die wrapped in stiff writing paper. D. Fusible metal die.

This makes a very accurate die and counter-die and if for any reason, the saddle does not fit nicely, it can be reswaged upon the artificial stone cast, in one of the plate swagers such as the Lyons, or the Pryor.

Another method of producing dies without recourse to sand moulding, is by the core method. (Fig. 370.) The cast is obtained in artificial stone and rubbed with talcum, or soapstone. Any hard investment material, which is used for soldering can be used for reproducing the cores. I prefer to use No. 90, powdered asbestos, mixed with an equal quantity of good casting plaster. This is mixed in a plaster bowl, and built up upon the cast to allow sufficient thickness for strength. If we are attempting to obtain a die for a horseshoe denture, of a complicated type, we pour the investment material only on the lingual surface, and only when the teeth do not lean towards one another. It should be poured on sufficiently thick to allow it to come about a quarter of an inch above the occlusal surface of the teeth. When it is hardened, it is carefully trimmed so that it presents a flat surface and is rubbed thoroughly with soapstone.

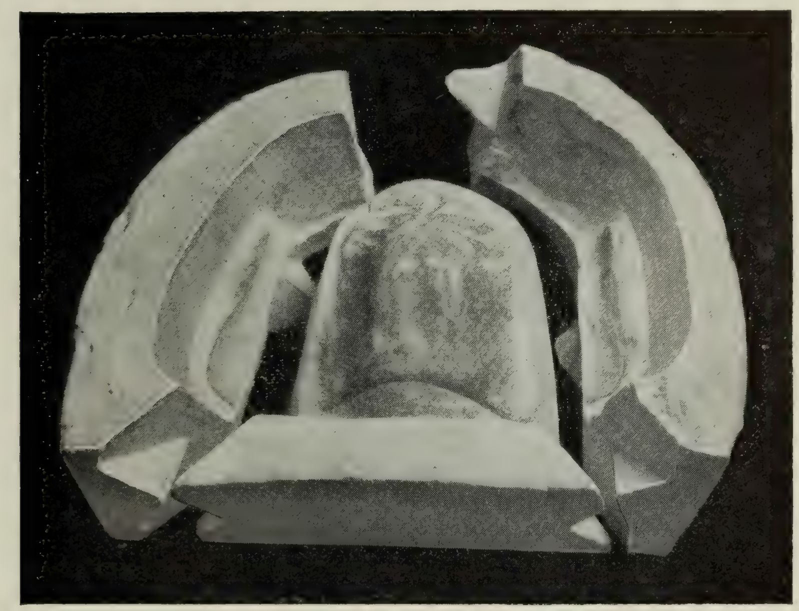

Fig. 370. Sections of core for Class I, upper case. The teeth have been sawed from the model to facilitate the work.

We should also ascertain if we can lift this from the cast. It must not be bound by undercuts between the teeth.

Next we set the cast with the core upon it on a glass plate and begin building four sections; one each on the buccal sides to the cuspid teeth; one for the labial faces of the anterior teeth; and one for the back of the cast. (Fig. 370.) These should be so made as to key into one another. I prefer to use a tapering flask on the outside so they will hold together tight. When they are hard, they can be pushed out of the tapering flask, separated, the cast removed, dried over a furnace, replaced in the flask and fusible metal or even Babbitt metal can be poured into the space which had been occupied by the cast. This makes a very nice model for use in a swaging machine. (Fig. 371.) In many instances the procedure can be simplified by constructing the back portion in one piece and the labial and buccal sides in two pieces, separating at the median line. (Fig. 370.)

Progressive Counter-Dies.

It may, however, be necessary to resort to a die and counter-die and if this is done, there is no better method than what is known as "progressive counter-dies" devised by Dr. A. DeWitt Grittman. The underlying principles of this method are to obtain sand moulds of the casts and produce zinc and Babbitt metal dies. The bases of the models must flare outwards to allow them to be drawn from the sand, and any undercuts on the buccal or labial surfaces of the teeth must be filled up with wax for the same reason.

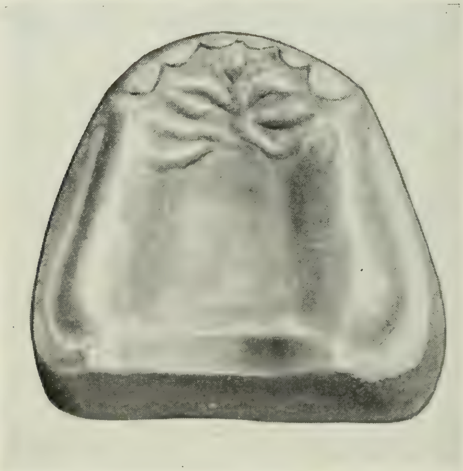

Fig. 371. Fusible metal, or Babbitt metal die, made from a sectional core.

In preparing my cast I give it one coat of shellac varnish, after it has been outlined. This helps to hold the wax when it is placed upon the cast. The rugæ and gingival margins on the gum are relieved. Any undercuts between the teeth are filled up with wax, the wax so shaped as to allow the model to be drawn from the sand and have a flat base. Undercuts on the labial or buccal surfaces of the teeth are also filled with wax.

Sometimes it is an advantage, when there are only a few teeth upon the cast, to saw them off, just above the gingival margin. If strengthening pins have been placed in these teeth, they should be made of brass rather than of steel, as brass will be easier to saw through. If a headless pin has been used it can be pulled out and the plaster tooth broken off.

In sawing a tooth from a cast, we should saw from the lingual to the buccal surface of the tooth, three-quarters of the way through, breaking the rest. The finest saw should be used and when we have reached the point mentioned, the tooth should be broken. Later, after we have finished making the dies and counter-dies, the tooth can be cemented back upon the model. The broken portion will give us the location and the sawed portion will allow us sufficient thickness of cement for strength. This sawing should never be done until the cast has received its final coat of varnish. If we should saw the teeth off before we varnish the cast, the varnish will get into the cut sections and prevent the cement from adhering when we place the teeth back on the model. I prefer sandarac varnish because it gives a fine gloss, much finer than shellac.

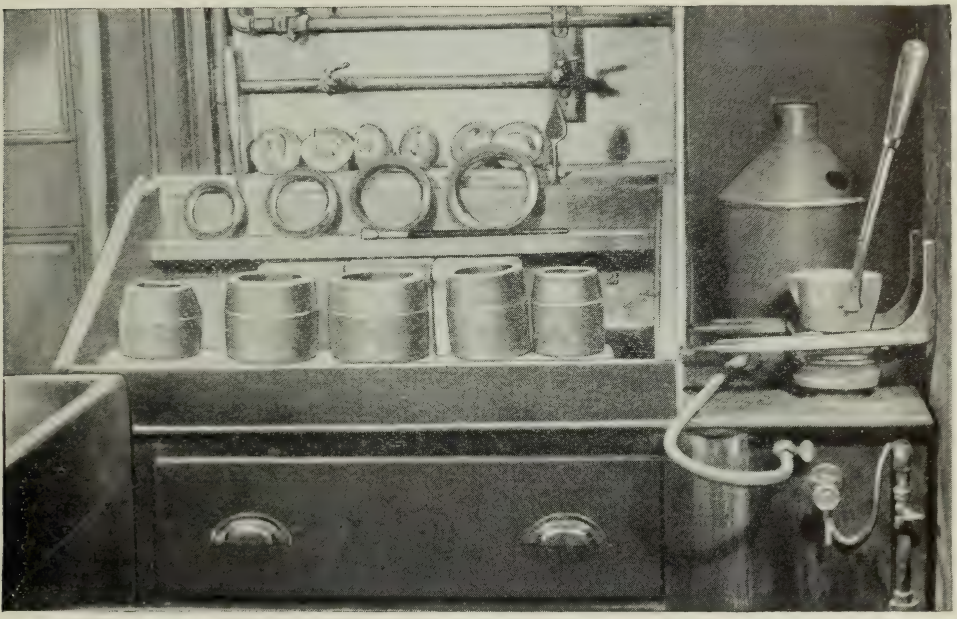

Fig. 372. Moulding bench, showing a series of Grittman rings. At the extreme left is seen an old fashioned Bailey flask.

Moulding Rings. When we have obtained a cast to our satisfaction, we proceed to mould in a moulding flask. A standard one is the Bailey flask, but Dr. Grittman has devised a series of rings cut from iron pipe, shown in the illustration of my moulding bench, (Fig. 372.) This illustration was made for the American text book of Prosthetic Dentistry and published by Lea and Febiger.

Calcar.

The sand used is known under the trade name of "Calcar" and was suggested by Dr. Grittman. Calcar is composed of eight ounces of glycerine mixed with eight quarts of the finest powdered marble dust. It is thoroughly mixed in the same manner as a mason would mix cement. It is passed through a No. 14 sieve and then packed in a tin can three successive times to allow the glycerine to permeate the marble dust. The glycerine absorbs moisture from the air, keeping the sand in a damp condition. It is practically odorless when using and it can be used over and over again. All that is necessary to recondition Calcar is to add glycerine and pass it through a sieve. This is necessary only after continued use.

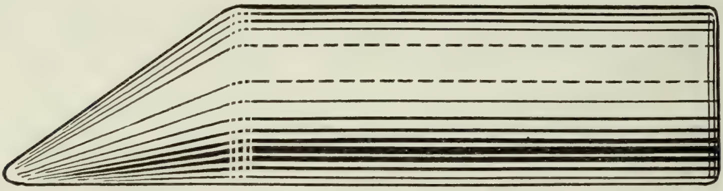

Fig. 373. Packing tool made from round stick of wood.

Technique for Sand Moulding.

The cast is placed upon the moulding board after it has been rubbed with soapstone, talcum or lycopodium powder and brushed off with a soft brush. A ring of suitable size is placed around the cast and the moulding sand placed inside the ring. The sand is pressed against the cast, with the fingers, and then pounded with a packing tool (Fig. 373) which is made of a stick about an inch and a half in diameter, six inches long and tapered at one end.

When the sand is thoroughly packed, it is smoothed on the upper surface of the ring and the ring reversed. The moulding trowel, or a spatula, is used to cut the sand down about 1 mm. below the edge of the cast so that the sand will not break when we are attempting to take the cast from the sand mould. The cast is tapped lightly with a small riveting hammer (Fig. 374) to loosen it from the sand, and some form of lifting device will be necessary to lift it out of the sand. A simple one can be made by taking a small brass crucible former, from our casting outfit, and soft soldering a handle in the center of it. (Fig. 374.)

This is placed upon the bottom of the cast where it protrudes from the sand and sticky wax is flowed around the edge. This lifter is grasped firmly in the fingers and attempt is made to draw the cast from the sand mould. If it should stick, a light tap of the hammer will loosen it and it can be drawn out of the mould. This is a much better method than dropping the cast out, for in dropping it out, we often obtain a drag. If any small pieces of sand are displaced, they can be pushed back into place with a camel's hair brush and by applying one drop of water, they will adhere. It would pay the student to go to an iron foundry and watch the men making moulds. Many things could be learned from them.

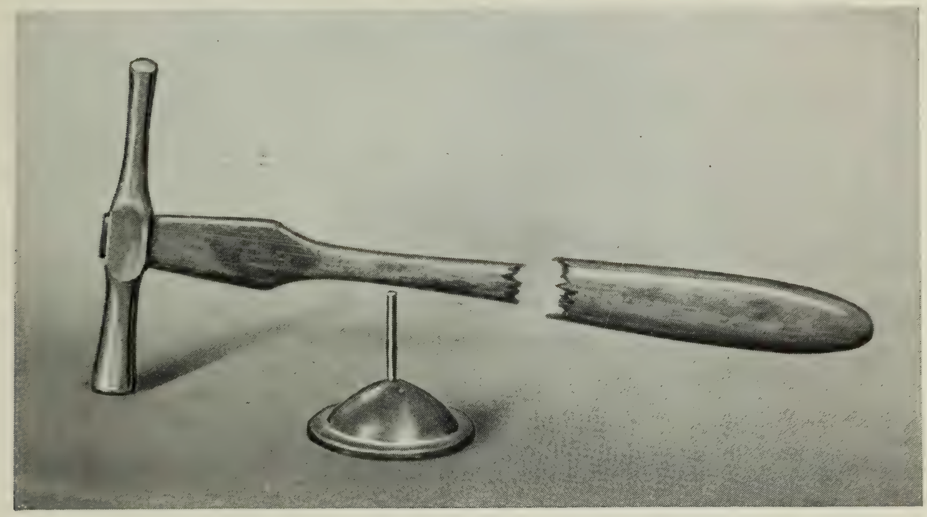

Fig. 374. Light hammer. Below, an appliance for lifting model from the sand mould.

Technique for Pouring Dies.

We are now ready to pour the dies. A second ring or a tapered ring is placed upon the first, and the zinc, or Babbitt metal poured into the mould. Care should be taken to direct the stream away from the saddles by means of the moulding trowel, to break the fall of the metal.

Zinc should never be poured when it is too hot, but just as the last piece of zinc melts in the pot. Babbitt metal should not be allowed to melt entirely. A good test is to have a pine wood stick with which to stir the Babbitt metal. The stick should char but not catch on fire. We learn to judge the heat of our metal when it is properly heated. The first portion of the die is easily poured but as we progress we will find that we must use the moulding spatula to assist the rest of the metal from the pot, because it will begin to congeal before we have finished pouring the base of the die.

Counter-Dies. Counter-dies are best made of lead, and should be made of the progressive variety; that is, first the palatal portion of the plate only is covered by the first counter-die (Fig. 375 B) just over the crest of the ridge; the second about 1 mm. down (Fig. 375 C) and the third should cover the entire plate outline but not beyond it. (Fig. 375 D.) Sometimes when swaging clasp metal, it may be necessary to use type metal counter-dies. Do not attempt to pour counter-dies upon a Babbitt metal die, unless you have coated the surface of the Babbitt metal with whiting, mixed with alcohol or water. Counter-dies made on the zinc dies can be made to fit Babbitt metal dies by giving them one blow with the hammer. After the dies and counter-dies have been obtained, a piece of tin foil about 36 gauge is used as a pattern and cut to the outline of the plate.

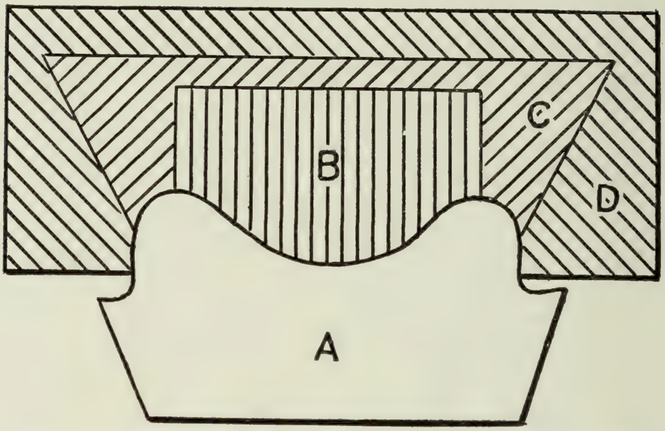

Fig. 375. Diagram showing construction of progressive counter-dies. A. Represents the model.. B. The first counter-die; C. The second counter-die, and D. The third. These counter-dies are independent, and not fitted, one within the other as the diagram might lead one to think.

I prefer to make this on the metal die rather than on the original cast. After it is cut it is flattened out and laid upon a piece of writing paper and a surplus of about one-eighth of an inch is left all around it. I do not mark in the indentations of the teeth, as it would be too difficult to locate them exactly when we begin swaging.

The paper pattern is laid upon the gold and the gold cut to the outline. The gold is annealed to a cherry red and allowed to cool off on the soldering block, until it is oxidized. This oxid protects the surface and it is not necessary to boil it in acid before each annealing. I have never burned a piece of gold before soldering. Some men think that the lead, adhering to the gold from the counter-die, will burn holes in the gold when we anneal it. This is not the case. The swaging is proceeded with, by pressing the gold somewhat to shape with the fingers, and if necessary, use a horn mallet. I prefer to cover the horn mallet with a rubber crutch-tip, as the gold is not marred if this precaution is taken.

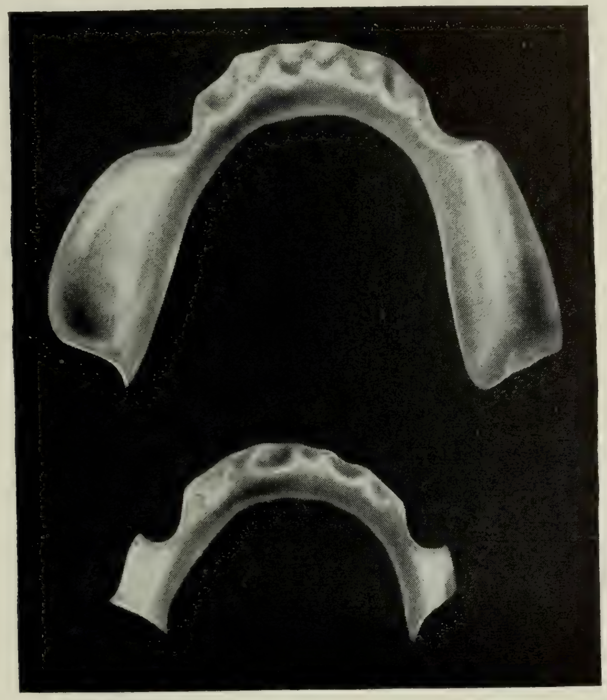

Fig. 376. Above, first lamina of plate swaged. Below, second lamina of metal, serving as a strengthening piece.

The first counter-die is used to swage the plate. If any wrinkles form, these are straightened out with a pair of pliers, or slit and the edges allowed to overlap. This slit can be soldered together when the swaging is finished. After the first portion is swaged, the second counter-die is

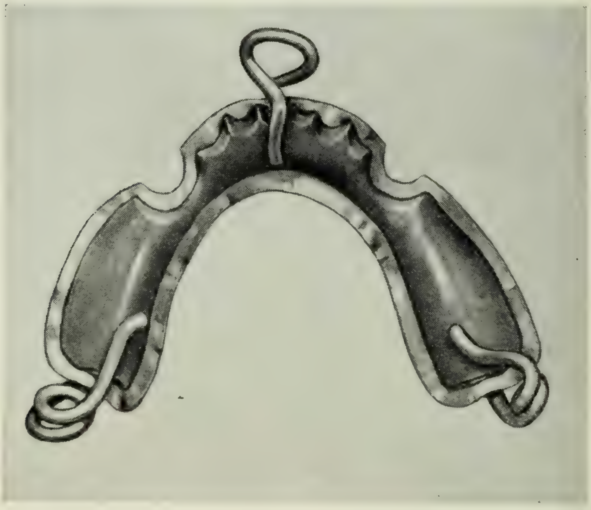

Fig. 377. Third lamina of metal swaged. The three adjusted together and held with clamps. Note how the clamp ends cross each other. This prevents opening when heated.

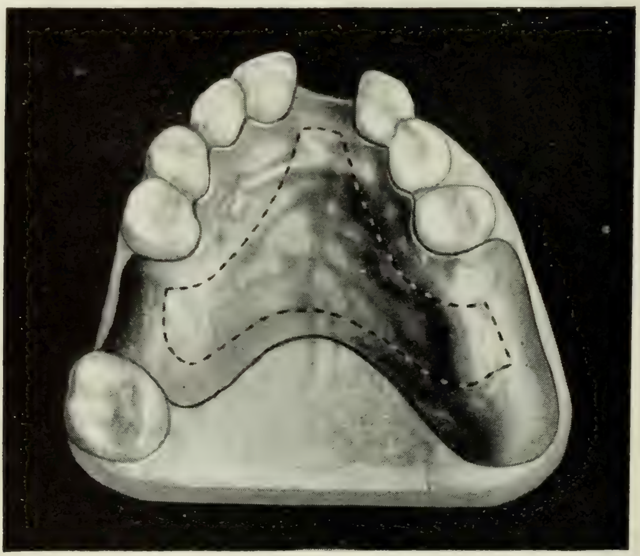

Fig. 378. Shows an upper swaged denture, for Class II, modification II. The dotted line outlines the strengthener.

used and then the third. The strengthening piece (Fig. 376) is then swaged and soldered to the first lamina of gold for the denture, and the rough surfaces of the solder ground down.

The next lamina of gold is swaged and cut exactly to the plate outline. The first lamina with the strengthening piece is placed upon the die, the second piece placed upon this, and swaged. If at any time a counter-die becomes enlarged from excessive swaging, it is not necessary to make a new counter-die. If you place a thickness of Johnson and Johnson cottonoid, (which is compressed cotton fibre used for placing between rubber dam and surface), moistening the same and applying it in the counter-die, it will fill up the voids and give us a very close adaptation.

These pieces of gold are pickled in an acid solution. I prefer to use 50 per cent. sulphuric acid and water, because the fumes do not rust the iron instruments in the laboratory as does the hydrochloric acid solutions.

The parts are thoroughly washed and fluxed, placed together and held with spring clamps. These clamps can be made of iron stove pipe wire, to form small clips, similar to a paper clip. They should cross and the ends should be brought together. If we do not cross them (Fig. 377) they will open up when heating.

Technique for Soldering.

The solder is cut in small pieces, fluxed and laid upon the first lamina of metal, around the edge of the second lamina, which explains the reason for leaving the first lamina larger than the second. It is placed upon the soldering block and a large brush flame of the blowpipe played upon it. As the solder melts, the flame is cut down slightly, to a more pointed flame, and the solder will follow the point of the flame. It can be drawn through from one side of the plate to the other.

In soldering a horseshoe type of denture, I prefer to put the solder only on the lingual side, drawing it through to the buccal and labial sides, when I know that it is thoroughly soldered.

The excess gold of the first lamina is then cut off and the plate swaged upon the Babbitt metal die, or the fusible metal model as the case may be.

Swaging small saddles is very much simpler, and it is seldom necessary to make the counter-dies progressive. The same principle is used in swaging and soldering as we would for a horse-shoe plate.

Fig. 378 shows an upper swaged denture, Class II, modification II. The dotted line shows the outline of the strengthener. The first lamina is swaged from pure gold, gauge 30. The second lamina, the strengthener, is gold clasp metal gauge 28. The third lamina, 22 karat gold, 28 gauge.

CHAPTER XXVIII

A Consideration of Denture Designs with Special Reference to the Avoidance of Pressure Against and Irritation of the Soft Structures

It is not my intention to describe in detail the construction of temporary vulcanite dentures, but in criticism of the design of these as made by dentists generally, I would say that they allow these dentures to terminate at the gingival margin of the teeth. These drive down, pressing the gingiva against the teeth, pinching off the blood supply, and producing the characteristic red fungoid growth of gum. If it should be necessary to make one of these dentures, the gingival margins of the teeth should be relieved with tin foil, a thin film of cement flowed upon them on the cast, or the impression should be relieved by scraping at this point.

In designing such a denture, the vulcanite should extend up on the basilar ridges of the anterior teeth and up to the height of contour on the posterior teeth. When the denture is put into place, if we notice that it reddens the gums after wearing for some days, the gingival margin should be further relieved by trimming with a bur and the patient should be instructed to discard the denture at night and in the privacy of his home. This procedure should continue until we can construct a more permanent denture, so designed that there is no excessive gingival pressure.

In a Class I type of denture it is very simple to do this as shown in Fig. 379. This illustration should be studied very carefully noting particularly the continuous clasp, constructed to rest on the teeth, above the gingival margin. Fig. 177 (page 208) also shows a tentative design for a Class I, upper case, the bar crossing the palate simply acting as a stabilizer. The structure should never be allowed to touch the gingiva. If it does, it will cause recession, and exposure of the cementum with its attendant sequelæ. Likewise, note the outline of the saddle and the bar in a lower case, Fig. 49 (page 58) and, for an upper case Fig. 59 (page 68).

Where the saddle joins the palatal bar the gingival margin should be relieved with a thickness of No. 7 Ash's tray metal, which is about 1 mm.

in thickness. The lines of the saddle and the bar should be continuous, flowing in nicely sweeping curves, as curves are less noticeable to the tongue than sharp angles. The bar should not cross the palate over a hard spot, if it can possibly be avoided. If we must do this, the hard spot should be relieved with No. 7 Ash's tray metal, thinned at the ends. This makes an uncomfortable bar for the patient, as there is a millimeter of space between the bar and the palate. The logical place for crossing the palate is on the soft tissue which connects the soft palate and the hard palate. This seems to cause no trouble, and is exactly at the same locality where we place our post-damming, for a full upper denture. It is situated about on a line between the third molar teeth.

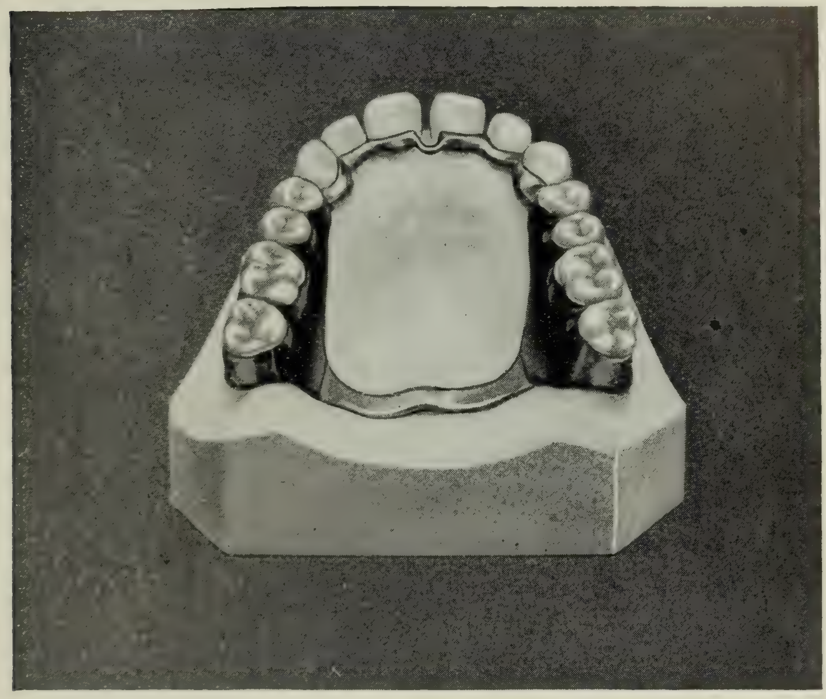

Fig. 379. Class I, upper denture designed to avoid gingival pressure.

I have had a number of men, in my classes, who were skeptical about this but after trying the method they have become more enthusiastic than I am. The method has the added advantage of giving an anterior and posterior stabilzation to the plate. In one case, Class II, modification I. upper, (Fig. 380) I was led to cross the palate just back of the rugæ, because of the fear of causing gagging. I was obliged to separate this bar twice, in three months, on account of injury to the median raphe. I made the patient a duplicate denture with the bar in the posterior position and after wearing it for about two months, she asked me to remake the first denture and place the bar further back in the mouth, declaring that it was much less noticeable to the tongue. The dotted line shows where the original bar was. This woman occupies a prominent position in charity work and is compelled to do a great deal of speaking. She is intelligent and realized that the continued irritation on the hard spot might induce cancerous growths.

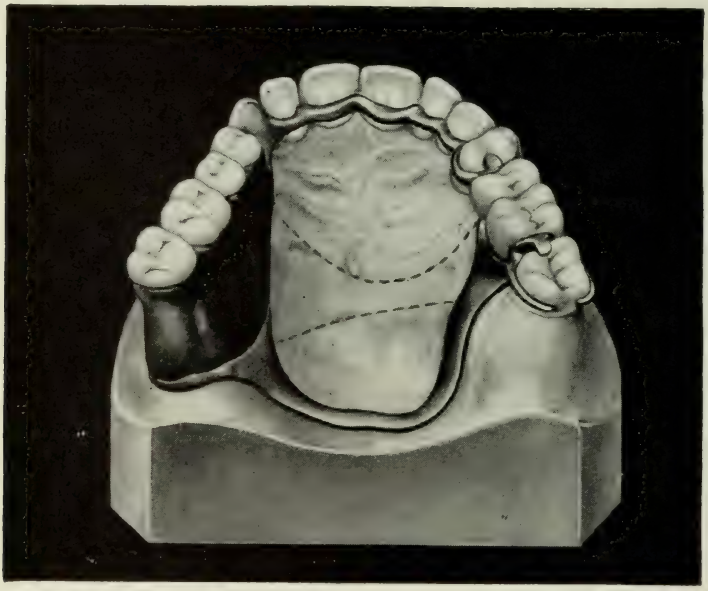

Fig. 380. Class II, modification I. Bar was originally placed as shown in dotted lines, but moved distally because of injury to the raphe.

Dr. George Semken, of the Crocker Foundation for Cancer Research, and Chief Surgeon of the Skin and Cancer Hospital, informs me that about two percent of the cancer cases of the mouth, are caused by plates, and, that in every instance in the maxillæ, these cancers are caused by pressure from air chambers, or bars pressing on the median raphe. Fig. 381 shows a Class III, modification I, case, constructed for a patient of his. Fig. 175 (page 206) shows a design for a similar case, following the Cummer method.

My main objection to this method is that patients very often are careless with their dentures, and then the little fingers which rest against the cuspid teeth cause them to be forced out of position. If they are made solid so they cannot be bent, they are cumbersome to the tongue. The advantage of the continuous clasp is that it is so shaped that it feels like teeth and after a few days, the patient becomes accustomed to it. They object, once in a great while, to an upper continuous clasp saying that it causes them to lisp, but in the course of a few days, this is overcome. I have had only three patients ask me to remove the continuous clasp. Two of these I replaced later and both of the patients have been frank enough to admit that it was imagination on their part.

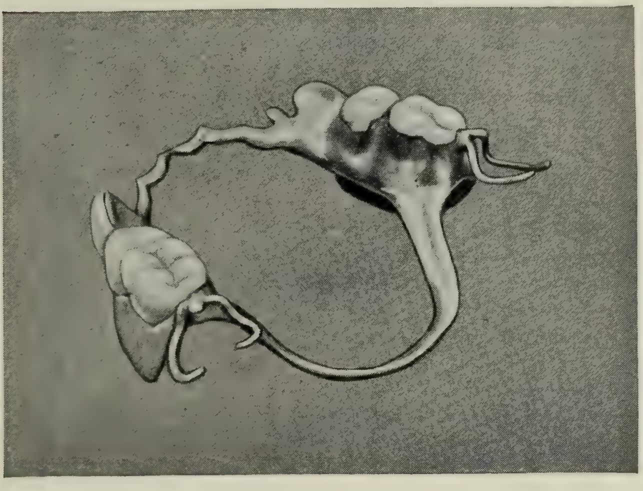

Fig. 381. Class III, modification I, upper denture. Note position of palatal bar, crossing the palate on a line between third molars. This patient had suffered greatly from gagging, but tolerates this bar with comfort.

Fig. 379 shows a finished Class I, upper denture. The little loop in the continuous clasp is left there for esthetic reasons as the patient had a space between the teeth and did not want to show gold. He wore the denture for six years, although it was only intended to be temporary. This long wear allowed the ridges to shrink from the saddles, which caused the denture to rock.

When this occurs we are liable to have breaks. In this instance the continuous clasp did not break, due to the fact that the loop of wire acted as a stress breaker. Since that time I have advised leaving the wire exposed at this point to act as a stress breaker, and if breakage does occur, it is easier to repair it.

In these cases, if the attached teeth are leaning far out of alignment with one another, it is best to use a stress breaker, although I find that the Jackson Crib on the end of a bar, acts as a stress breaker and at the same time, as an indirect retainer. If the denture drops at the back, pressure can be brought to bear on the wire of the Jackson Crib which crosses the anterior occlusal embrasure. If it presses too hard at the back, pressure should be placed on the wire that crosses the posterior occlusal embrasure. Fig. 174 (page 205) shows an indirect retainer which is very acceptable, designed by Dr. Cummer. By running it up on the anterior side of the bicuspid, and resting on the occlusal surface, there is no danger of moving the tooth. Care should be taken not to run this bar too close to the gingival margin. Fig. 175 (page 206) shows a tentative design for a Class III case, handled in a similar manner to the Class II case, and was very satisfactory.

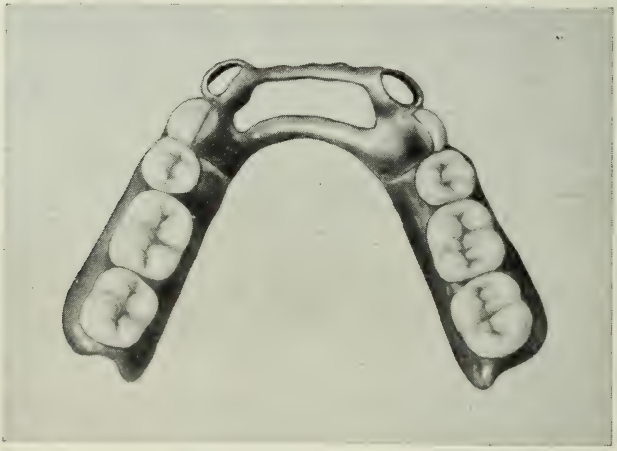
Fig. 382. Method of attaching teeth to continuous bar, using Steele facings.

Fig. 382 shows a Class I, lower case, where the patient had nine repairs in a year on a former denture due to breaking the first bicuspids (artificial) but after using Steele facings attached as shown in the illustration, she has used it since without breaking the teeth. If the clasps should break, they can be resoldered by the repair method described in the next

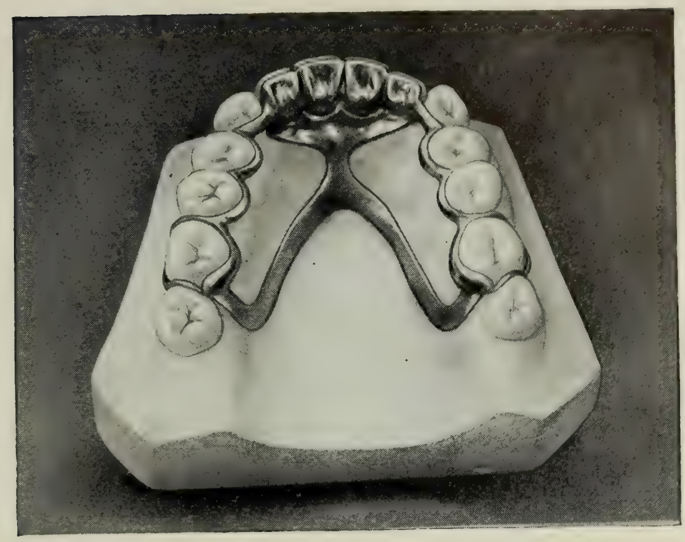

Fig. 383. Class IV, upper denture constructed with continuous clasps. Progress of periodontoclasia was arrested by substituting this for a horseshoe type of denture.

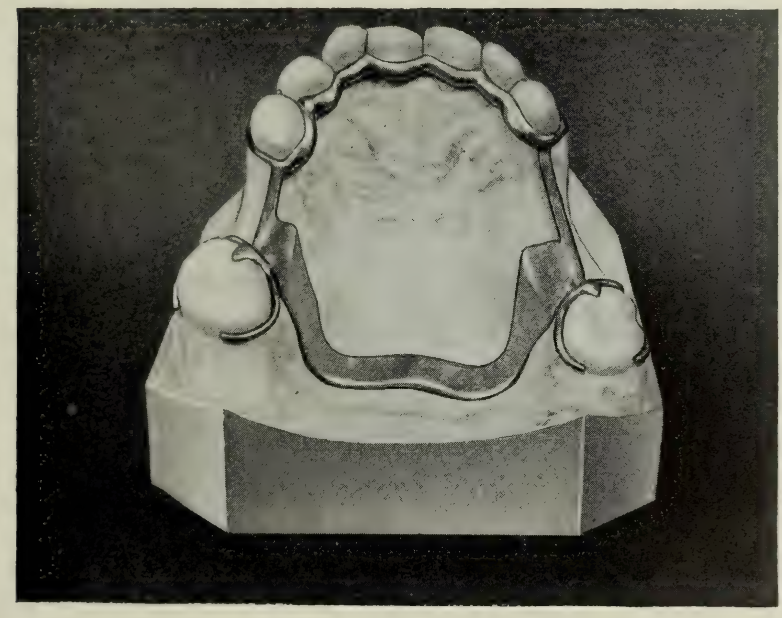

Fig. 384. Frame for palatal bar denture, without vulcanite. Note the finishing line on the bar where vulcanite saddles are to start.

chapter, without removing the vulcanite from the denture. If the posterior teeth are tube teeth without vulcanite attachments, the repair is very simple. Fig. 90 (page 94) shows a tentative design for a Class IV, upper case. The bar here runs across the median raphe in the interspaces between the rugæ. Care should be taken that this bar does not press against the hard spots, but as the continuous clasp carries the stress of mastication, we have no trouble.

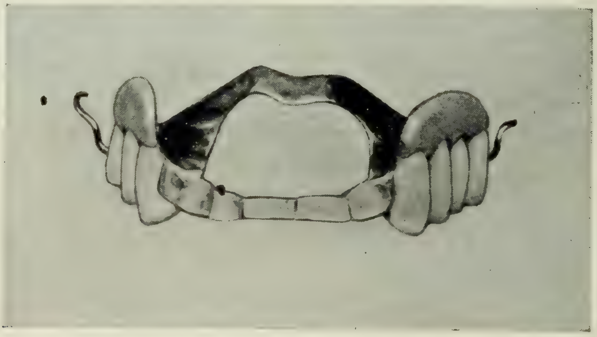

Fig. 385. An open palate denture made from a well fitting, swaged gold plate, which was causing gingival irritation. The palatal portion was cut out of the plate, and the remaining parts strengthened with wire and solder.

We should be constantly on the watch to see that no irritation is caused. If we fear this, I would much rather design a horseshoe type of denture, relieving the gingival margins and running the plate well up on the basilar ridges of the anterior teeth, and above the height of contour on the buccal teeth to remove the stress of mastication from the gingiva. Fig. 383 shows a Class IV, upper case, similar to one worn by a patient who had suffered disastrous results from bridgework, starting with the loss of one tooth due to splitting of the root by a Logan crown; then the loss of a central incisor; next the loss of the two lateral incisors due to a bridge being placed on them, fastened by Carmichael attachments; and finally injury to the molars due to her dentist's cutting between the teeth for clasps to hold a horseshoe plate, causing recession of the gums and inducing pyorrhea pockets. Further progress of the disease was arrested by the present denture which has been worn for two years and the gums have maintained a healthy condition.

Fig. 176 (page 206) shows a design for a denture, similar to what Cummer would use, and I believe that it is a little safer to use this design, although, if it were supplemented with continuous clasps, it would be more

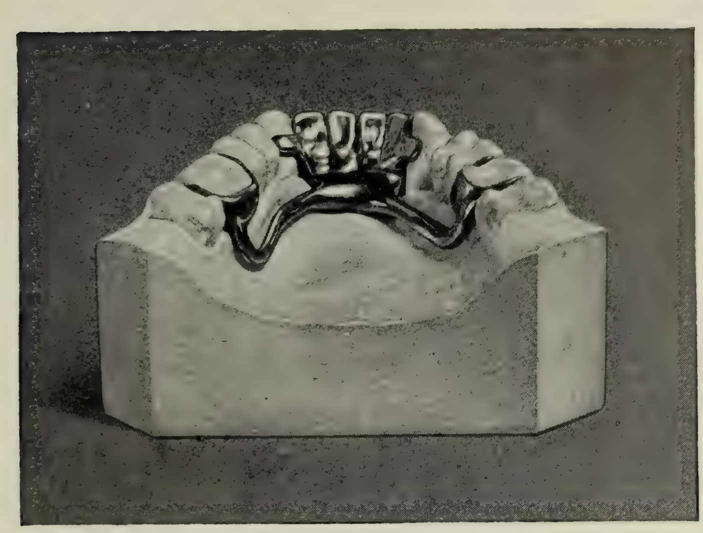

Fig. 386. Class IV, lower denture, with Jackson cribs. Carving the palatal surfaces of the anterior teeth gives comfort to the tongue.

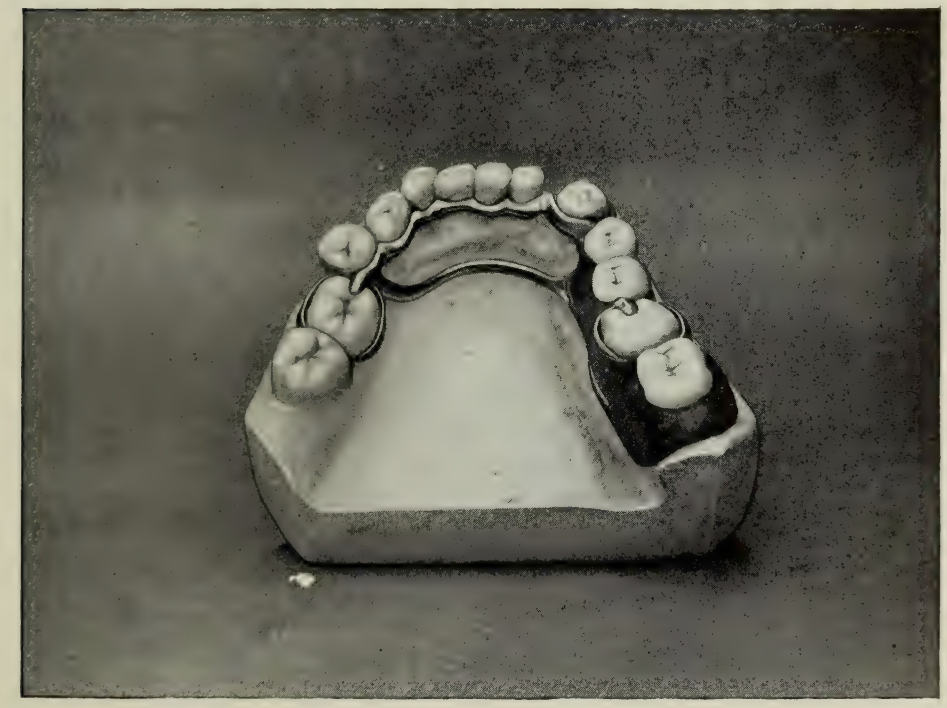

Fig. 387. Class II, modification I, denture. This patient had a marked periodontoclasia and has worn this denture for ten years without further loss of teeth.

steady in the mouth. While it might be more cumbersome, there is no danger of pressing against the hard spots, and if the patient is careful in the care of it, it makes a satisfactory denture. The student should study very carefully the Cummer designs, as they are most excellent. Likewise, all designs for saddles and indirect retainers shown in Chapter XI, page 203. They are typical cases and variations may become necessary.

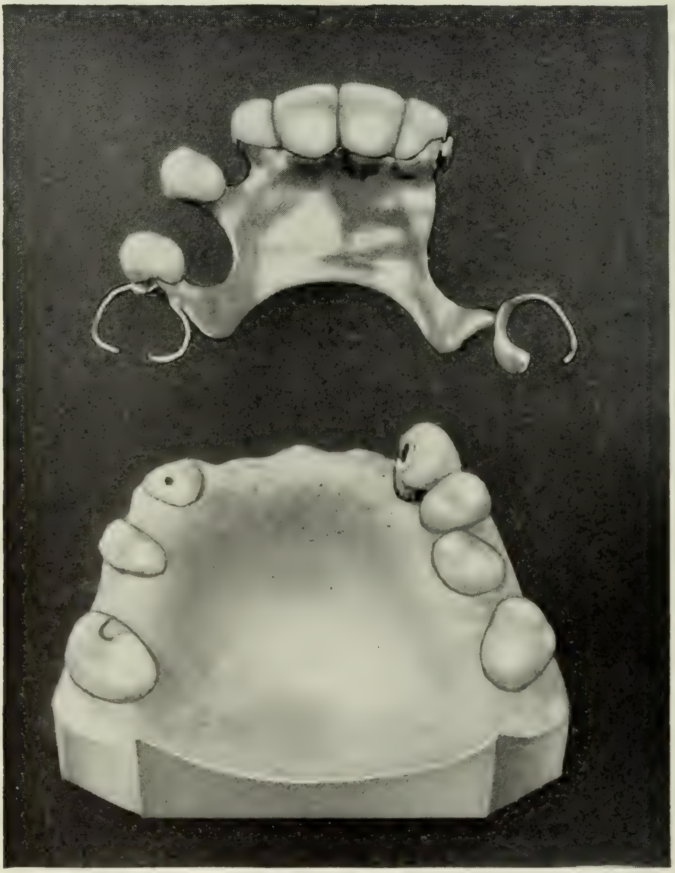

Fig. 388. Class III, modification II, upper denture, constructed by Dr. Strausberg of Newark. The case is interesting because of the varied attachments used on a single denture.

Fig. 181 (page 212) shows a tentative design for a Class I modification I, case. If the bite is not too close, I would not hesitate to carry a single tooth upon the anterior bar, widening the bar out at the opening between the teeth to gain support and also placing a saddle under the tooth supplied. Modification II, shown in Fig. 182 (page 212) would best be handled by swaging a horseshoe plate, and either relieving the gingival margin on the cast, or cutting the plate out and strengthening it to prevent breakage. Fig. 183 (page 214) shows a Class II, modification I, which is self explanatory. Fig. 184 (page 214) shows a Class II, modification II, denture. Where the anterior saddle is extensive, as in this illustration, the bar must run back to the posterior saddle to steady it and in some cases, where the bite is very strong, it might better be supplemented with a similar bar on the opposite side.

In Class III, modification II, (Fig. 186) where lateral incisors are missing, they can always be carried on a continuous clasp provided we design it wide enough to gain sufficient support.

Fig. 384 shows a frame work for a palatal bar denture with Gillett clasps, without the rubber attachments. If the teeth are firm we can dispense with the anterior continuous clasp. These frames should always be tried in the mouth to see that no warpage has taken place in the soldering; the clasps should be tightened and the frame tried again in the mouth before the rubber saddles are attached.

I prefer to attach the anterior bar, or continuous clasp, with a piece of half round wire, and if warpage has taken place, bending with a pair of pliers can be resorted to, refitting on the model. The posterior bar is a cast one in Fig. 384, but in Fig. 381, it is a constructed one. Whether we cast it or construct it, a little line should be left, to which to finish our vulcanite. This makes a much neater piece of work. Fig. 385 shows a continuous bar which was made from a well fitting swaged plate which was producing gingival injury to the patient. The center of the plate was sawed out and the anterior continuous bar strengthened with wire and 18 karat solder; likewise the posterior bar. I do not like the location of this bar, however, as it crosses the hard spot, but there was a sufficient space between it and the palate to prevent pressure.

Fig. 386 shows a very satisfactory Class IV type of lower denture where only the anterior teeth are supplied. With this type of construction, where we are using Jackson cribs to support it, I would advise that the Jackson cribs should be made on separate casts and placed in the mouth when the impression is taken. If the bicuspids are loose, a continuous bar can be extended between the Jackson cribs and the anterior teeth, to give it extra support.

Fig. 387 shows a Class II, modification I, lower denture. This patient had a marked case of periodontoclasia and the plate was constructed to act as a splint. He wore it for ten years without any further loss of teeth. Where we are using a resting lug, as on a molar, it is generally advisable to construct the denture and rebase the case after the proper occlusion has been obtained. This prevents rocking.

Fig. 388 shows a Class III, modification II, upper denture, constructed by Dr. Straussberg of Newark. This case has different forms of attachment; the slotted, the pin and tube, the Gillett and the half matrix clasp. It has proven very satisfactory to the patient and due attention was given to relieving the gingival margins of any pressure.

CHAPTER XXIX

Methods of Repairing and Rebasing Dentures

Repairs become necessary because of the following: First, we may have the breakage of teeth or clasps. Second, breaks occur in the vulcanite. Third, breakage of the bars and gold bases. Fourth, the need for rebasing, or for the addition of teeth where extractions have been made after the denture has been constructed.

The prime importance in making a repair is not to disturb the occlusion, provided it is correct. Many men take the denture apart to solder it, and in attempting to get a new impression, will spoil the fit, not only of the gold part of the work, but of the occlusion as well. It is seldom necessary to remove the teeth, or vulcanite from the gold, to make a repair, but if this must be done, it is best to put the plate in the patient's mouth and take an impression over it without removing the teeth, so that we obtain the relationship of the plate to the natural teeth. Then pour a cast, and, after removing the modeling compound, we place it upon an articulator and block the teeth, which consists in oiling them with vaseline and just covering their occlusal surface with plaster. If there are anterior teeth present, we cover the cutting edges and about one-third of the labial faces. For this purpose, I use what is known as the Handler "Fool-proof" articulator. It is built somewhat on the principle of the plain line articulator but has a precision lock, which prevents any side to side movement. This is shown in Fig. 162 (page 187).

Now if it is necessary to remove the vulcanite, we have not disturbed the relationship, and, after the gold has been repaired, it is a simple matter to put the teeth back in their original position in wax, and revulcanize. By this method, the patient is only compelled to come twice; once for the impression, and once when the repair is finished. It eliminates taking the bite and trying the teeth in the mouth.

Repair of Clasp. In a Class I type of case, where we have bars attached to rubber saddles, if a clasp breaks, it is much better to cut the rubber out as shown in Fig. 389 and bend a clasp to fit in this cut and then bend it around the tooth and revulcanize the rubber in the cut, rather than to take the piece apart and solder it. It is a strange fact, but the clasps, when attached in this manner, last longer without breaking, than when they are soldered directly to the bar. The fracture nearly always occurs at the soldered joint, and I believe it is due to crystalization of the gold when soldering.

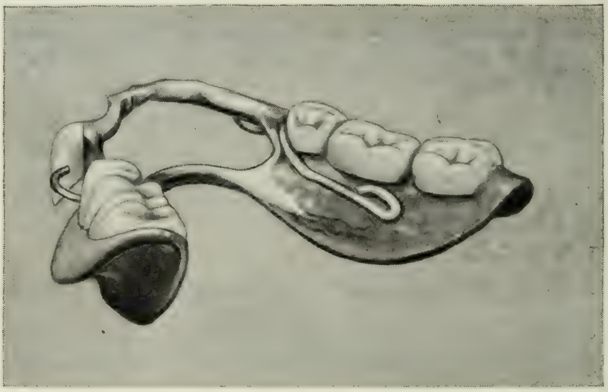

Fig. 389. Repairing broken clasp. Vulcanite cut away, and new clasp supplied with wire attached to engage in the rubber.

Repair of Vulcanite Dentures.

If we have an ordinary horseshoe plate made of vulcanite, or one covering the full palate, we should hold the two parts of the plate together with a roll of wax pressed against the lingual side of the posterior teeth. I use a roll of yellow beeswax about the thickness of a lead pencil, sealing it tightly to the teeth, with the parts approximately in their correct relationship. Then I bring the joints together and fasten them with sticky wax as shown in Fig. 390. While the wax is still soft, I turn the plate over and see if it is close together on the other side. If it is not, all that is necessary is to press the finger against the pencil of wax. This will lengthen the wax and the joint will come together. A cast is poured, the wax removed and the break at the joint should be widened about 1 mm. with a vulcanite file, or with a bur so as to expose a clean surface of vulcanite. The rubber is thinned down on each side of the joint to a distance of about a half inch. If the edges are cut sharp with a wheel bur, it makes a nice finish for the new rubber shown in Fig. 391.

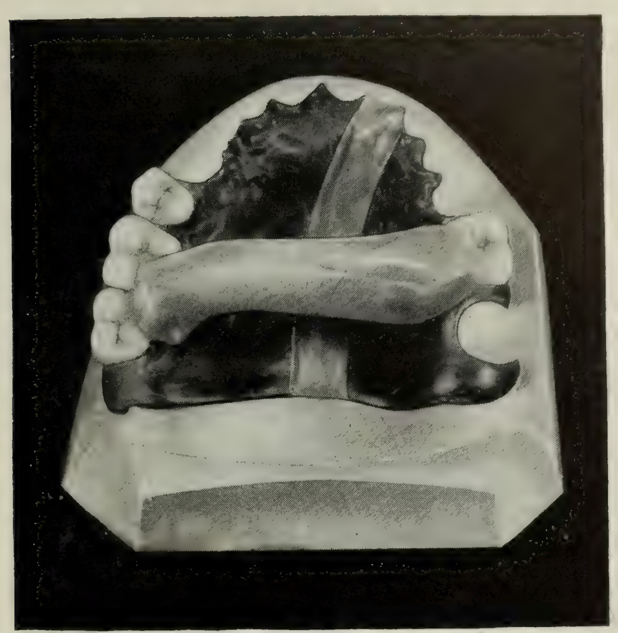

Fig. 390. Repair of broken vulcanite plate. The parts held with a roll of wax. Sticky wax along the line of fracture.

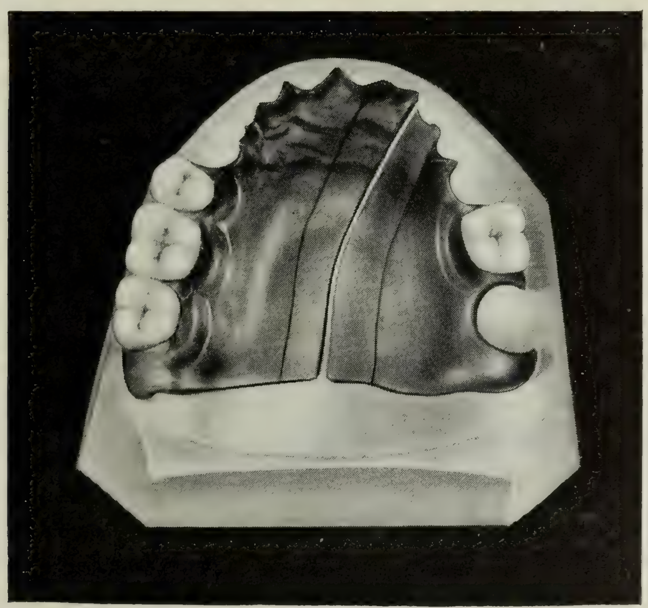

Fig. 391. Repair of broken vulcanite plate. The break is widened 1 mm. with a rubber file, the edges thinned, and a finishing line made with a wheel bur.

The parts are placed back on the cast and the repair part is waxed in. It is best not to flow this wax from a spatula, as it will adhere to the vulcanite, and will be hard to get out; just warm the wax and press it to place with the fingers. The wax is smoothed down and the plate flasked, covering everything but the wax.

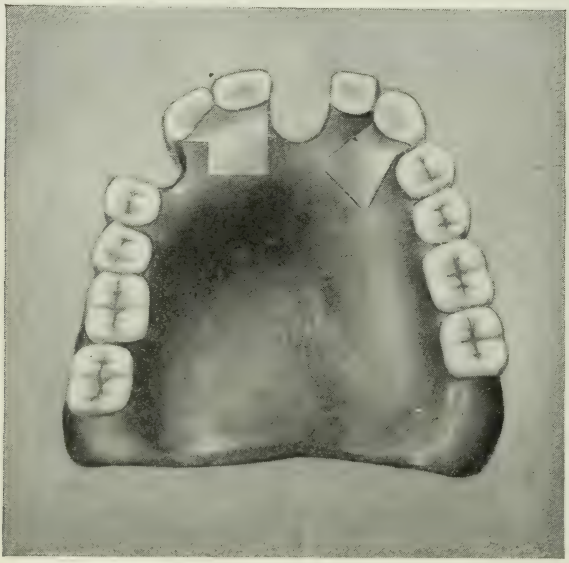

Fig. 392. Dovetails cut, when single teeth are to be supplied.

The second half of the flask is then poured and when the plaster has hardened, we are ready for the separating. Do not heat the flask too much, as you should not melt the wax and have it run into the porous rubber, where we are repairing the joint. The wax is lifted out, unvulcanized rubber packed in, and the plate vulcanized and finished. This forms a lap joint, which is the strongest possible joint.

It is not necessary, if the new surface of the rubber is clean, to make dovetails, especially if the fracture is in the palate, as the plate is thin in this area, and if we make too many dovetails, the plate will fracture along the line of the dovetails. Dovetails are strong where they are arresting tension but are weak where deflection takes place. If a single tooth is lost, it is a good idea to dovetail back of the tooth (Fig. 392), but where we have a long fracture in the palate, we have only deflection to contend with, and a lap joint is best for the purpose.

Wherever possible, make the repair so that it does not show, as for instance, when we are attaching a clasp for a Class I, lower, it is just as easy to cut the rubber away along the whole side, so that all of the lingual surface will be new rubber. In this case, and in a case where we are adding single teeth, we can often dry-pack the case if we use a little extra rubber for finishing.

Effects of Vulcanization on Rubber.

I have discovered, by a series of experiments, and I believe my findings are correct, that rubber vulcanized at 290° F. produces shrinkage of the rubber; 300° F. maintains it in its correct form and 320° F. causes it to expand. Now if we are dry packing, we want some expansion, so we vulcanize it at 320° F. for one hour and fifty-five minutes.

When it comes out of the vulcanizer, surplus rubber can be trimmed down. Do not do this, however, if we have a large bulk of rubber in the repair as we will obtain porosity.

Repairing Continuous Bars

It is quite a simple matter to solder a continuous bar without removing the rubber from the plate, by using the following technique. This also applies to the addition of single teeth to bars, and also a flat plate where it is beginning to fracture, provided the break is not too close to the rubber. I have soldered as close as a quarter of an inch without burning the rubber. Even if the vulcanite should become scorched, it is a simple matter to strip off the scorched portion, dry-pack it and revulcanize. This method has the advantage that the occlusion of the teeth is not disturbed.

In the case of a double bar, if it is not bent out of position, all that is necessary is to wax it together and pour a cast in ordinary investment material. This portion of the investment should only touch the gold. When it is set, and dried in a warm place, over a radiator, or near an electric light, which gives us sufficient heat to dry the investment without warping the rubber, we mix an investment of half powdered asbestos (which can be purchased from the Johns-Manville Co., for about sixty cents a bushel) and half ordinary cast plaster. Wet the asbestos and mix the plaster with it. This is placed on the soldering block, and the plate with the ordinary investment on it, is settled down into it. The rubber is covered with the wet asbestos, as shown in Fig. 397, and we solder the gold with an oxyhydrogen blowpipe. (I use a Lenox). The wet asbestos will prevent the rubber from burning. If the repair is close to the rubber, we apply the solder to the joint, having thoroughly fluxed it, and with an ordinary medicine dropper in one hand, and the blowpipe in the other, we begin to solder. As the investment dries, we wet it with water from the medicine dropper. Do not wet the ordinary investment but only the asbestos investment which covers the rubber.

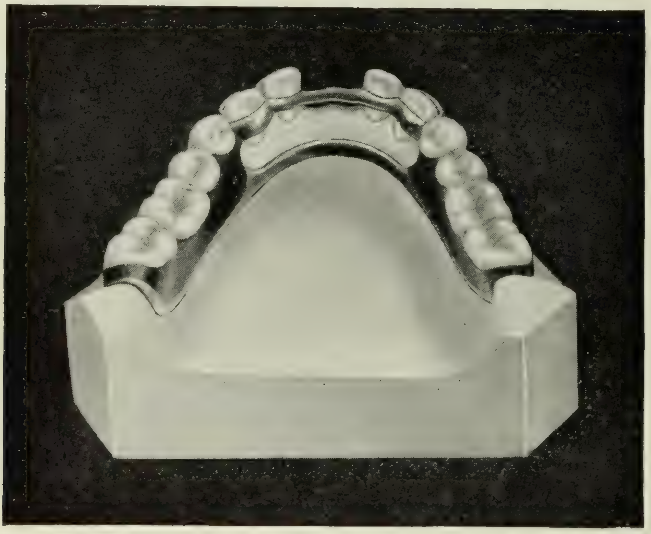

Fig. 393. Class I, continuous bar denture. Two teeth to be added. Plaster teeth have been cut from cast.

The Addition of Teeth

In many instances, where we are making a lower denture with a continuous clasp, the patient has some anterior teeth which are loose, but are under treatment for pyorrhea. The periodontist believes they can be saved for some years, and wants the missing teeth supplied to prevent trauma around these weakened ones. The patient does not feel that he wants to go to the expense of a denture if it should so happen that the teeth should be lost in a short time. Fig. 393 illustrates a case of that nature. Two anterior teeth were loose, and the patient was assured that they could be added at any time, provided the teeth that held the clasps remained firm. The method of adding these teeth is as follows:

Two days before the teeth are to be extracted, a lingual impression is

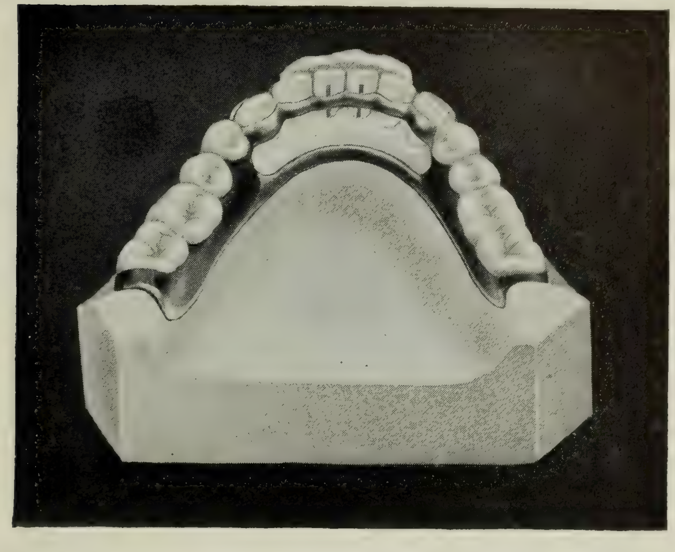

Fig. 394. Steele facings ground to fit and held in place with a plaster index.

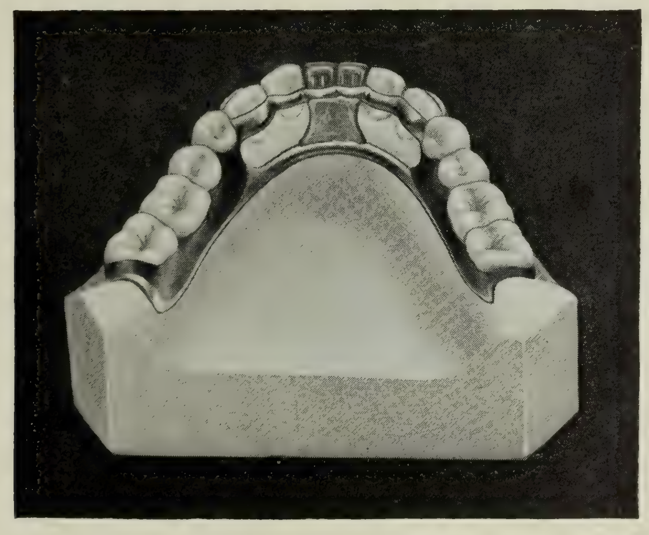

Fig. 395. Pattern is made of casting wax, of the part needed to attach the teeth.

taken, with the plate in the mouth, to obtain the relationship between the teeth and the bar. Then the labial section is taken, the plate lifted from the mouth with the lingual section in place, the labial portion attached to it and the cast poured. The denture is removed from the cast and the

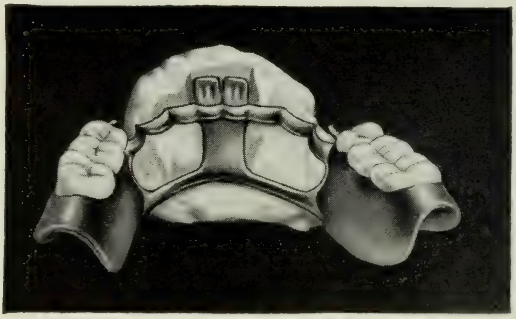

Fig. 396. Wax pattern reproduced in gold, waxed into position, and assembled parts held in correct relation with inlay investment.

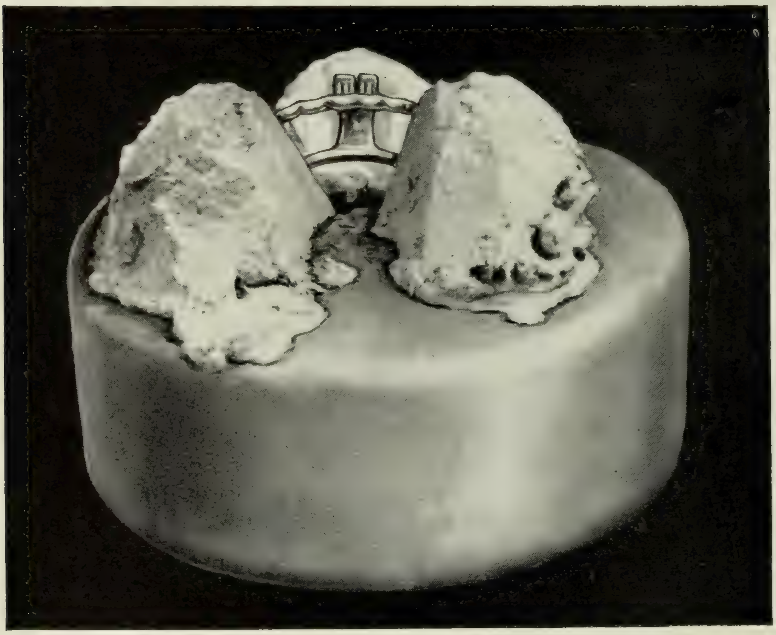

Fig. 397. The assembled parts held on the soldering block, and all rubber protected with asbestos investment.

two teeth to be extracted are sawed from the cast, Steele facings ground to fit, and a wall of plaster built to hold them in position. (Fig. 394.)

These facings and the gold bars are oiled, as well as the cast where the addition is to be made. A small mass of green inlay wax is melted

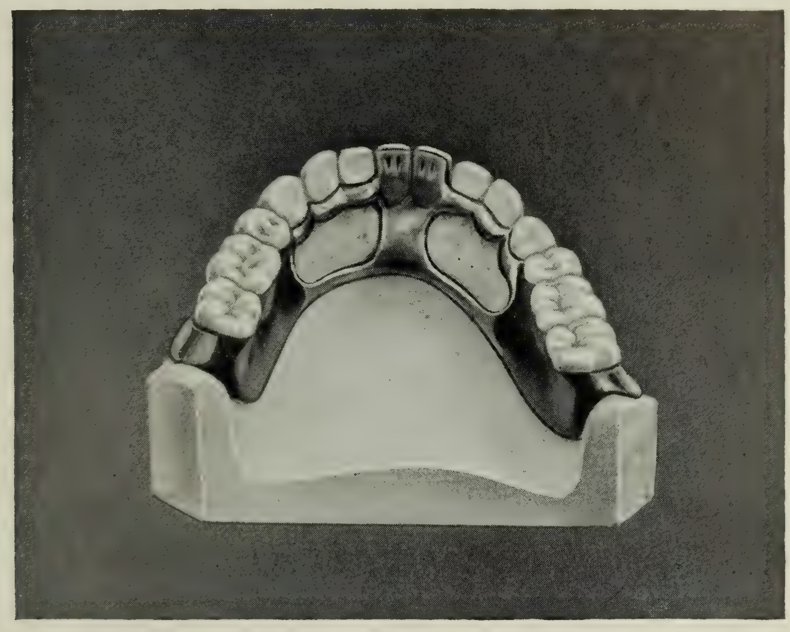

Fig. 398. The finished piece after adding two teeth. Done without removing the vulcanite.

into the opening, and while it is still warm, the denture is pushed into place on the cast.

The wax is carved to represent the lingual surfaces of the teeth and extended to run down to the lower bar. (Fig. 395.) The denture is lifted off and likewise the Steele facings. It is not necessary to use backings, as the wax will cast accurately enough to make backings. The wax pattern is cast in gold, replaced on the cast, and held to the denture with sticky wax. Its relationship is held by means of ordinary inlay investment similar to the repair mentioned above, (Fig. 396), dried in a gentle heat, not too hot to warp the rubber and the wet asbestos investment placed around it on the soldering block. (Fig. 397.) The sticky wax is melted out, the parts fluxed and soldered with an oxyhydrogen blowpipe. By this method we have the minimum amount of soldering to do. In fact we are only connecting the upper to the lower bar. The finished repair is shown in Fig. 398. Fig. 399 shows a plate where I added a cuspid, not more than a quarter of an inch away from the rubber, without burning the rubber and as I said before, it would be no serious matter if the vulcanite should be slightly scorched, as we can cut it away and revulcanize without disturbing the occlusion of the teeth.

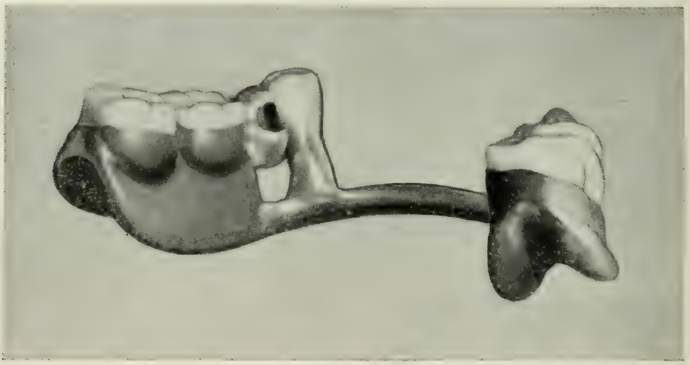

Fig. 399. A cuspid added to a bar by the same method, without injury to the vulcanite.

Rebasing Dentures

Nesbett's Method. It is often necessary to rebase a denture and I think the simplest method is Dr. Nesbett's which consists of cutting the rubber away from the saddle side, starting at the crest of the ridge and cutting about 2 mm., tapering down to the edge of the plate to about 1 mm. as shown in Fig. 400. This can be filled in with black carding wax, either melting it in a suitable receptacle, and painting it on with a small paint brush, or the carding wax can be rolled down into a very thin sheet and placed on the denture with the fingers. The wax is lightly warmed in a Bunsen flame, and then placed in the patient's mouth, letting him bite it into place, chewing lightly upon it until the occlusion is even on both sides. Then let him make all the movements of the tongue and cheek, if it is a lower case. If it is an upper, it must be held in place with the fingers, and the cheeks pulled down at the sides.

It is carefully lifted out of the mouth and any surplus wax that has crawled out on the buccal, or lingual sides, is trimmed off with a sharp knife. We now just heat the edges of the wax, replace it in the mouth and complete the muscle trimming. It is then placed in a flask, completely covering the rubber up to the edge of the wax, and also the gold bars. The plaster is smoothed down, a separating medium put upon it and the second portion of the flask is poured, care being taken that no air bubbles are formed on the surface of the wax. It is separated, the wax washed out with extremely hot water, and new rubber packed in the space left by the wax, vulcanized, trimmed and polished.

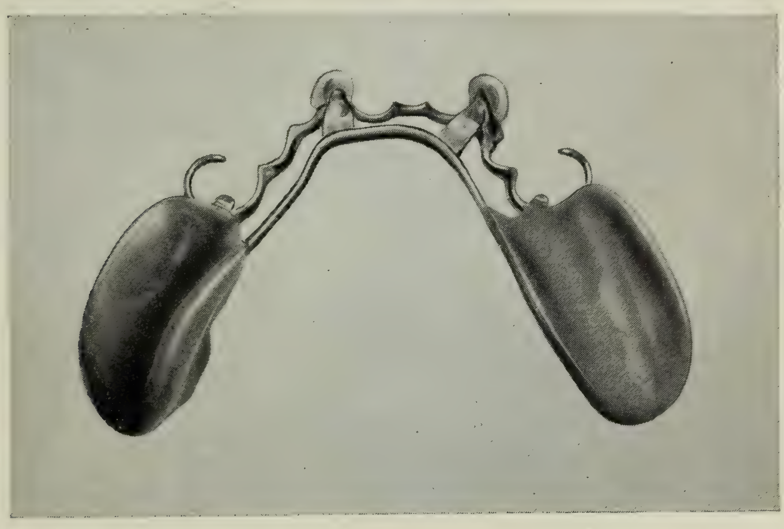

Fig. 400. Rebasing vulcanite saddles. Right side of illustration shows underside of saddle cut with bur, ready to receive the wax. Left side of illustration; saddle has been filled with black carding wax, and impression of saddle area taken in this manner. The piece is ready for flasking and vulcanization, after the other saddle has been similarly treated.

If there is an excessive amount of shrinkage, it is best to have the patient test it out before vulcanizing. In this case, instead of using black carding wax, I use wafers of Kerr modeling compound. Sometimes it is necessary to use three thickness of these wafers before the occlusion is brought back to what it originally was. It is safe to let the patient wear it a week with the modeling compound in place, provided he does not clean it in hot water, nor use soap.

If there are bilateral saddles in the lower arch, it is always best to rebase both saddles, and it is advisable to cut out the rubber before applying either the compound, or the wax, as it is difficult to cut it after it is flasked. Also when we are just post-damming the upper, it is practically impossible to get a nice finish unless the cutting is done before applying the post-damming.

If any plate rocks upon testing, it should always be rebased and Dr. Nesbett claims that rebasing by his method stops a great deal of shrinkage. A few years ago, I held a different opinion but now I have changed my mind, because I have noticed that dentures that are not stable, produce irritation and absorption.

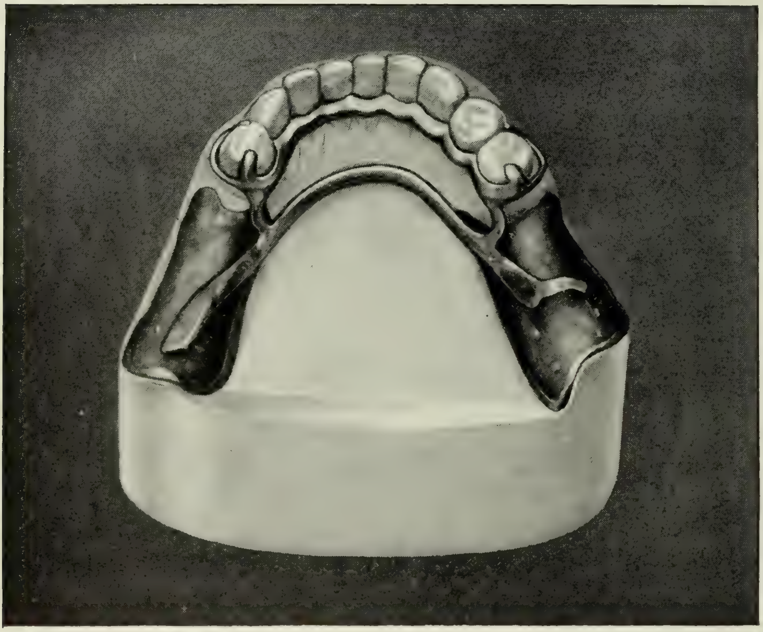

Fig. 401. Gold saddles cast separately from bar. Ready for vulcanization which will unite the bar and saddles.

I have also found that if a patient comes in with the ridges sore, especially under small saddles, instead of attempting to relieve the trouble by trimming, we can get better results by rebasing it immediately, particularly if the patient has little white spots upon the ridge. This shows that the tissue has hardened, and when we rub a finger over the ridge the spots are tender and rough. I believe these hard spots are small pappilomas and they are much more easily relieved if we stabilize the denture by rebasing rather than by cutting away the saddles.

Rebasing Gold Saddles.

I seldom make gold saddles for partial lower dentures, as they are hard to rebase. I believe that, aside from the fact that they are a little easier to keep clean, they do not maintain the health of the tissues any better than a vulcanite saddle, vulcanized on tin foil or celaphane, although where you deem it necessary to make a gold saddle for a lower denture, especially for Class I type of dentures, it is possible to swage or cast a saddle separate from the bar as shown in (Fig. 401) allowing vulcanite attachments to unite the bar with the saddles. Should it become necessary to rebase this type of denture, we apply rebasing wax under the gold saddle, and then flask it in the same manner as for an ordinary rubber rebasing. When we have separated the flask, the gold will be exposed, and by carefully heating it with a pointed flame of the blowpipe, it will loosen from the rubber and can be taken out and reswaged, if it is a swaged saddle, upon the cast which is in the opposite side of the flask.

In these cases, it is best to pour the second half of the flask in stone, so that we can swage it in a swaging machine. When it is swaged, the rubber is cut out because it will be slightly burned from the blowpipe, and new rubber packed in.

If it is a cast gold saddle, we will be obliged to make a new wax pattern on the model side of the flask, cast it, place it into position and proceed in the same manner as for the swaged saddle.

This makes a very satisfactory form of denture, especially where we are using a gold saddle when teeth have been recently extracted, although where we have had fresh extractions and want to apply gold next to the tissues, I prefer to use what is known as "perfection base," which is pure gold with pure gold mesh wire soldered over it. This is very thin, about 36 gauge, and is readily stripped off the rubber, a new piece burnished to the model and rubber supplied between, vulcanized and finished. In finishing "perfection base," never file towards the gold. Always file from the gold towards the rubber, or you are liable to loosen it.

In rebasing a gold plate which has tube teeth upon it, if the shrinkage is excessive, the only thing we can do is to recast the saddles to a new impression. If the shrinkage only equals about 28 or 20 gauge of metal, it is possible to rebase with ordinary base plate casting wax, first having lightly oiled the saddle area and having the wax extend over the buccal and lingual surfaces which have not been oiled, and sealed in place. Then when we lift it from the mouth, we pour a cast of inlay investment material in the wax. This cast should be very small, and when it has hardened it should be trimmed down to the edges of the gold saddle with a sharp knife. This will release the wax and sprues can be placed upon it and invested in a casting flask, while still on the cast which was poured into it.

After having cast it, it is placed back upon the gold plate and soldered around the edges. It does not make a very satisfactory form of repair, as it increases the thickness of the saddle and tends to increase for weight.

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